



Product Catalog 2026

Hydraulic Servo Control System Solutions



WeChat Official Account



Linkedin @Forever Electro-Hydraulic



+86 13817906696



www.wxforever.com



- Displacement Sensors

Analog
SSI
Industrial Bus
- Fluid Sensors

Liquid Level and Temperature Sensors
Digital Display Temperature Sensor
Digital Display Pressure Sensor
- Hydraulic servo power unit

Compact servo hydraulic power unit
Standard servo hydraulic power unit
Silent power unit
Hydraulic oil distribution substation
Large hydraulic power unit
- Servo actuator unit

Servo valve
Low-friction sealed servo hydraulic cylinder
Hydrostatic bearing servo hydraulic cylinder
Clearance-sealed servo hydraulic cylinder
Oscillating cylinder
EHA electro-hydraulic actuator cylinder ESP
bidirectional servo motor-pump set
- DELTA controller

RMC70
RMC200 LITE
RMC200 STANDARD

A **hydraulic servo system** is a hydraulic control system that uses hydraulic oil as the working medium and achieves automatic following of the output (such as position, speed, force) to changes in input commands through feedback control. Its core is closed-loop control of “command-feedback-correction,” characterized by high precision and large thrust/torque. A high-precision hydraulic servo control system is composed of a hydraulic servo power source, servo cylinder, displacement sensor, load sensor, servo control valve group, and servo motion controller.



Contents

Company Introduction	03
Sales Network	05
Displacement Sensors	06
Displacement Sensor 7.1 Analog/SSI/EtherCAT/PROFINET	07
Displacement sensor 7.6 Analog/SSI/PROFINET	19
Fluid Sensors	28
Liquid Level and Liquid Temperature Sensor LT	29
Digital Display Temperature Sensor TS	32
Digital Display Pressure Sensor PS	35
KS Pressure Sensor	37
8008A Pressure Gauge	44
Proportional Servo Valve	47
F633 Direct-Drive Servo Valve	48
F634 two-stage servo valve	58
F761 rotary direct-drive servo valve/F200 rotary direct-drive servo valve/F300 rotary direct-drive servo valve	67
F400 servo valve/F661 servo valve	84
Hydraulic Servo Power Unit	97
Compact servo hydraulic power unit	98
Standard servo hydraulic power unit	100
Silent hydraulic power unit	105
Hydraulic flow distribution substation	110
Large servo hydraulic power unit	112
Servo Actuator Unit	117
Low-friction sealed servo cylinder	118
Hydrostatic support/clearance-sealed servo cylinder	121
Rotary (oscillating) cylinder	125
EHA - servo motor-pump unit/EHA - electro-hydraulic actuator cylinder	127
Hydraulic Servo Controller	133
RMC70 Series Single/Double-Axis Touch Motion Controller	134
RMC200 Series 1-50 Axis High-Performance Motion Controller	137
Hydraulic Servo Design Guide	138

Company Introduction

Sensors, servo valve control system,
servo pump control system

“

Forever Electro-Hydraulics is a company based on hydraulic servo and automated motion control technology. We independently develop various sensors related to hydraulics—such as displacement, pressure, and flow—along with hydraulic servo systems and high-frequency actuators, and provide supporting hydraulic software algorithms to deliver a complete hydraulic servo solution for mid to high-end customers. The company is primarily dedicated to high-end intelligent equipment industries such as aviation, aerospace, defense, automotive, lithium battery, and testing.

Specialized in hydraulic servo & proficient in high-end equipment



Forever has professional hydraulic and electrical design teams that customize hydraulic power units, servo cylinders, servo control systems, and upper-computer software with different functions according to customer needs. In collaboration with foreign sensor experts, Forever is developing a new generation of high-precision magnetostrictive displacement sensors to achieve domestic substitution, continuously adding value to customers' products.

With innovative thinking, an concept of integrity, and an inclusive mindset, Forever will grow together with employees, customers, and partners, achieving win-win cooperation that endures.



High-Tech
Enterprise



Certified by CQC-ISO9001
Quality Certification



North America
SGS Certification



German Components
Safety Certification Mark



CE
Safety Certification Mark

Domestic Sales Network



★ North China Office - Shenyang, Xi'an, Beijing, Jinan, Qingdao
(North China)



★ Wuxi R&D Center & Cylinder Production Base
Wuxi (East & Middle China)



★ Jiangsu Forever Electro-Hydraulic Servo Production Base
Wuxi (East & Middle China)



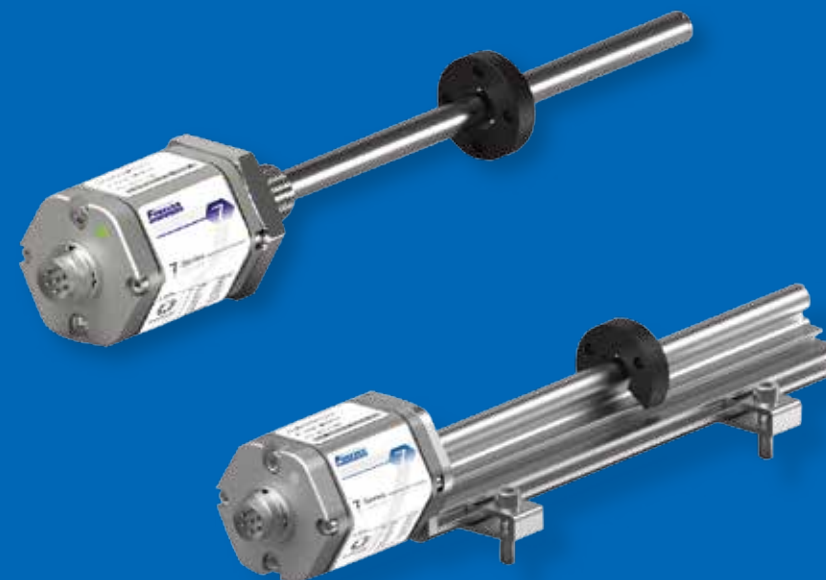
★ South China Office - Foshan, Hong Kong
Foshan (South China)

Displacement Sensor Linear Sensor

- Analog



- EtherCAT®



Series 7.1/Analog Output



- Rugged, reliable industrial displacement sensor
- Linear measurement, absolute output
- LED indicator for diagnostics
- Non-contact measurement, no wear
- Nonlinearity up to 0.01%
- Repeatability up to 0.001%
- Built-in cylinder installation
- Easy-split design, no depressurization required for replacement
- Supports multi-magnet position detection
- Supports position + speed, synchronous signal output

Product features:

Model selection code

7.1 - 1 - X - X X X X - X - X - X

a

b

c

d

e

f

a Mounting method	d Connection type	
1 = Metric M18x1.5	1 = 6-pin M16 male plug	5 = 2 m high-temperature cable, pigtail
	2 = 2 m standard cable, pigtail	6 = 5 m high-temperature cable, pigtail
b Measurement dead zone (start/end)	3 = 5 m standard cable, pigtail	7 = 10 m high-temperature cable, pigtail
1 = 50.8 mm/63.5 mm	4 = 10 m standard cable, pigtail	
2 = 29 mm/60 mm		
c Measuring range	e Output signal (one magnet per output group)	
Unit: mm. Pad with leading zeros to four digits,	A10 = current 4–20 mA	V10 = Voltage 0–10 V
Increment in 5 mm steps from 0025 to 7600 mm	A11 = Current 20–4 mA	V11 = Voltage 10–0 V
f Speed output:	A20 = Current 0–20 mA	V20 = Voltage –10–10 V
Speed range 1: 0.1–10 m/s (0001–0100)	A21 = Current 20–0 mA	V21 = Voltage 10––10 V
Speed range 2: 25–90 mm/s (1025–0190)		

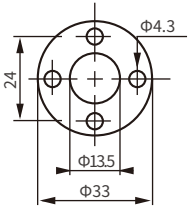
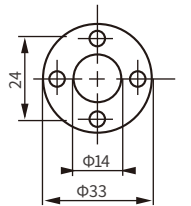
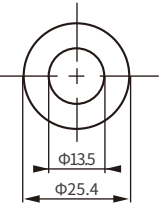
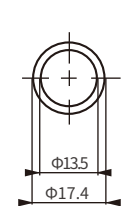
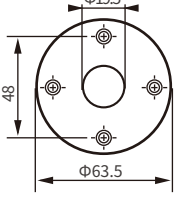
Example: 7.1-1-1-0050-1-A10

7.1 Series Built-in Displacement Sensor - Metric M18x1.5 - Null/Dead Zone 50.8 mm/63.5 mm - Stroke 50 mm - 6-pin M16 male connector - Output signal: 4–20 mA

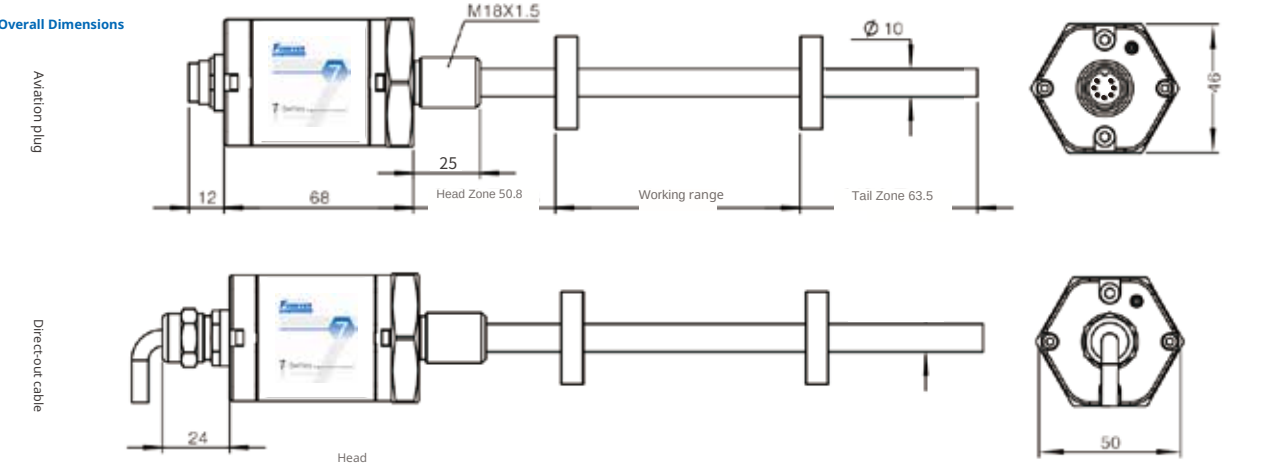
Project name	Parameter specifications
Measurement parameters	
Measuring range	25~7600mm
Output signal	0~20 mA (minimum/maximum load: 0/500 Ω) 4~20 mA (minimum/maximum load: 0/500 Ω) 0~10 V (minimum load > 5 kΩ) -10~+10V (minimum load >5k Ω)
Resolution	16-bit D/A
Nonlinearity	<±0.01% F.S. (min. ±50 μm)
Repeatability	<±0.001% F.S. (min. ±1 μm)
Update time	0.5 ms (range < 1 m) 1.0 ms (1 m < range < 2 m) 2.0 ms (2 m < range < 4 m) 4.0 ms (4 m < range < 7.6 m)
Electrical characteristics	
Wiring method	Waterproof cable gland or six-pin aviation connector
Input voltage	24VDC(-15/+20%)
Operating current	<50mA (varies with measuring range)
Insulation capability	500V (between signal ground and housing)
Polarity protection	Max -30VDC
Overvoltage protection	Max 36VDC
Fault indication	Red/green dual-color LED indicator
Operating conditions	
Magnet speed	Any
Ambient temperature	-40°C ~ +85°C
Humidity/dew point	Humidity 90%, no condensation
Temperature coefficient	< 30 ppm/°C
Protection rating	IP67
Pressure rating	35 MPa (continuous)/70 MPa (peak)
Installation accessories	
Installation orientation	Any
Installation method	Threaded installation, M18x1.5 or user customization
Position magnet	Ring magnet OD33, OD25.4, OD17.4
Structural materials	
Sensor head	Aluminum alloy
Outer protection rod	304L stainless steel
Mounting flange	304L stainless steel

Project name	Parameter specifications
Measurement parameters	
Measuring range	25~7600mm
SSI signal	24-, 25-, 26-bit binary or Gray code
Transmission speed	70kBd~1MBd Cable length: <3 <50 <100<200<400 m Rate: 1000<400<300<200<100 kBd
Resolution	0.5/1/2/5/10/20/50/100 μm
Nonlinearity	<±0.01% F.S. (minimum ±40μm)
Repeatability	<±0.001% F.S. (±1 digit)
Update time	Stroke: 300 750 1000 2000 5000 mm Frequency: 3.7 3.0 2.3 1.2 0.5 kHz
Electrical characteristics	
Wiring method	Waterproof connector or 7-pin aviation plug
Input voltage	24VDC(-15/+20%)
Operating current	<60 mA (varies with measuring range)
Insulation capability	500V (between signal ground and housing)
Polarity protection	Max -30VDC
Overvoltage protection	Max 36VDC
Fault indication	Red/green dual-color LED indicator
Operating conditions	
Magnet speed	Any
Ambient temperature	-40°C ~ +85°C
Humidity/dew point	Humidity 90%, no condensation
Temperature coefficient	< 15 ppm/°C
Protection rating	IP67
Pressure rating	35 MPa (continuous)/70 MPa (peak)
Installation accessories	
Installation orientation	Any
Installation method	Threaded installation, M18x1.5 or user customization
Position magnet	Ring magnet OD33, OD25.4, OD17.4
Structural materials	
Sensor head	Aluminum alloy
Outer protection rod	304L stainless steel
Mounting flange	304L stainless steel

Magnetic Ring

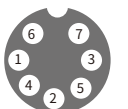
	Ring magnet: OD33	Isolation spacer: DP33	Ring magnet: OD25.4	Ring magnet: OD17.4	Ring magnet: OD63.5
Product image					
Product CAD					
	Magnetic ring thickness 8 mm.	Magnetic ring thickness 5 mm.	Magnetic ring thickness 8 mm.	Magnetic ring thickness 10.5 mm.	The magnetic ring thickness is 10mm.
Product Applications	Scope of use: Series 7, Series 4, Series 3 Operating temperature: -40°C~+85°C Mounting screw: M4x18 Preload torque: max 1 N·m				

Overall Dimensions



Note: The pressure-resistant probe of the 7 Series can be easily separated from the electronics head (two M4x59 screws), enabling quick replacement without depressurization. The pressure-resistant probe can become a permanent fixture.

Wiring diagram

SSI Output Pin Definition				Status Indicator		
 Male Connector Pin Layout (Facing the sensor head direction)	Pin Number	Wire Color	Definition		Indicator Light Status	Definition
	1	Gray	Data (-)		Green light on	Normal operation
	2	Pink	Data (+)		Green light flashing	Programming mode
	3	Yellow	Clock (+)		Red light flashing	Magnet ring out of measuring range
	4	Green	Clock (-)		Red light on	Magnet ring not detected or magnet ring damaged
	5	Brown	+24VDC power supply (-15/+20%)			
	6	White	DC power ground (0VDC)			
	7		Not connected			

Series 7.1/EtherCAT output



- Rugged and reliable industrial displacement sensor
- Linear measurement, absolute output
- LED indicator for diagnostics
- Non-contact measurement, no wear
- Nonlinearity up to 0.01%
- Repeatability up to 0.001%
- Resolution up to 1 μm
- Built-in (in-cylinder) installation
- Quick-release design, no need to depressurize for replacement
- Supports multi-magnet position detection
- Supports position + speed, synchronous signal output
- Direct EtherCAT output

- Multi-magnet position measurement

- Speed measurement

EtherCAT

Product features:

Temperature Range

EMC

Vibration/Shock Resistance

Absolute Value

Magnetic Field Protection

Quick Removal

High IP Protection Rating

Short-circuit Protection

Reverse Polarity Protection

High Resolution

High-Pressure Resistance

Model selection code

7.1 - 1 - X - X X X X - X - X X X

a

Installation method

1 = Metric thread M18x1.5 (flat-bottom flange)

d

Connection type

1 = two 4-pin M12 plugs, one 4-pin M8 power connector

b

Measurement dead zone (front end/rear end)

1 = 50.8 mm/63.5 mm

2 = 29 mm/60 mm

e

Output

c

Measuring range

ECT1 = standard version, single magnet

Unit: mm. Pad with leading zeros to four digits,

ECT2 = multiple magnets + number of magnets

Increment in 5 mm steps from 0025 to 7600 mm

Example: 7.1-1-1-0050-1-ETC1

7.1 Series Built-in Displacement Sensor - Metric thread M18x1.5 (flat-bottom flange) - Null zone/dead zone 50.8 mm/63.5 mm - Length 50 mm

2 sets of 4-pin M12 connectors, 1 set of 4-pin M12 power connector - ECT1 = EtherCAT, standard version, single magnet

Project name	Parameter specifications	
Measurement parameters		
Measuring range	External type: 25-5000 mm	Built-in type: 25-7600 mm
Interface	EtherCAT	
Data transmission rate	Up to 100 MBit/s	
Resolution	Position: 1-100 μm optional Speed: 1 mm/s	
Nonlinearity	<±0.01% F.S. (min. ±50 μm)	
Repeatability	<±0.001% F.S. (min. ±2.5 μm)	
Update time	Depends on the stroke	
Jitter	<5 μm	
Hysteresis	<4 μm	

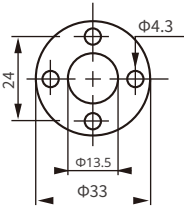
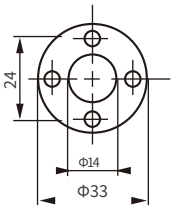
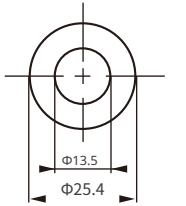
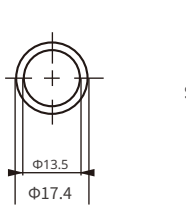
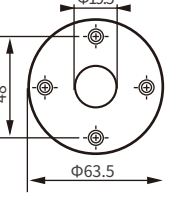
Electrical characteristics	
Connector selection	Two 4-pin M12 signal connectors; one 4-pin M8 power connector
Input voltage	24 VDC (-15/+20%)
Power consumption	Typically 110 mA
Insulation capability	500V (between signal ground and housing)
Polarity protection	Max -30VDC
Overvoltage protection	Max 36VDC
Ripple	≤0.28 Vpp

Operating conditions	
Magnet speed	Any
Ambient temperature	-40°C ~ +80°C (up to +85°C)
Humidity/dew point	Humidity 90%, no condensation
Temperature coefficient	<15 ppm/°C
Protection rating	IP67
Vibration rating	15 g/100-2000 Hz/IEC 68-2-6 standard

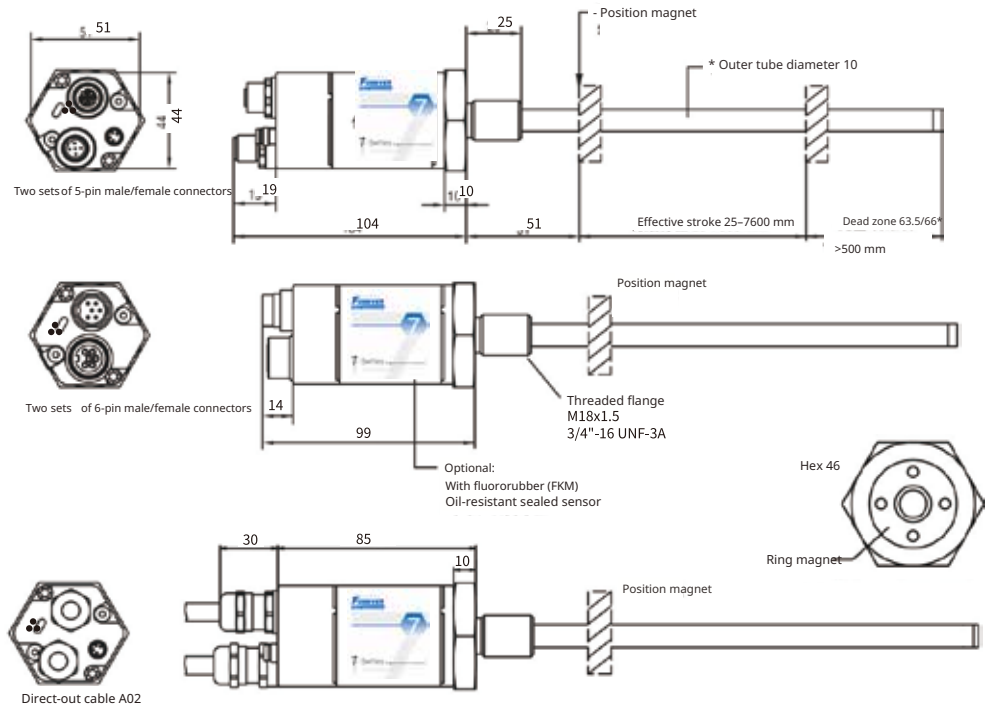
Installation accessories	
Installation orientation	Any
Installation method	Threaded flange M18x1.5 or 3/4"-16 UNF-3A
Position magnet	Ring magnet or floating magnet

Structural materials	
Sensor head	Aluminum alloy
Outer protection rod	304L stainless steel
Mounting flange	304L stainless steel

Magnetic Ring

	Ring magnet: OD33	Isolation spacer: DP33	Ring magnet: OD25.4	Ring magnet: OD17.4	Ring magnet: OD63.5
Product image					
Product CAD					
	Magnetic ring thickness 8 mm.	Magnetic ring thickness 5 mm.	Magnetic ring thickness 8 mm.	Magnetic ring thickness 10.5 mm.	The magnetic ring thickness is 10mm.
Product Applications	Scope of use: Series 7, Series 4, Series 3 Operating temperature: -40°C~+85°C Mounting screw: M4x18 Preload torque: max 1 N·m				

Overall Dimensions



Wiring diagram

EtherCAT output pin definition (Facing the sensor head direction)

Signal	Pin Number	Wire Color	Function
	1	Yellow	Tx+
	2	White	Rx+
	3	Orange	Tx-
	4	Blue	Rx-

Power supply	Pin Number	Wire Color	Function
	1	Brown	+24VDC (-15/+20%)
	2	White	n.c.
	3	Blue	0V (GND)
	4	Black	n.c.

7.1 Series/PROFINET Output



- Rugged and reliable industrial displacement sensor
- Linear measurement, absolute output
- LED indicator for diagnostics
- Non-contact measurement, no wear
- Nonlinearity up to 0.01%
- Repeatability up to 0.001%
- Resolution up to 1 μm
- Built-in (in-cylinder) installation
- Quick-release design, no need to depressurize for replacement
- Supports multi-magnet position detection
- Supports position + speed, synchronous signal output Direct
- PROFINET output
 - Multi-magnet position measurement
 - Speed measurement



Product features:

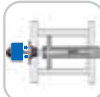

Temperature Range


EMC


Vibration/Shock Resistance


Absolute Value


Magnetic Field Protection


Quick Removal


High IP Protection Rating


Short-circuit Protection


Reverse Polarity Protection


High Resolution


High-Pressure Resistance

Model selection code											
7.1 - 1 - X - X X X X - X - X X X											
a				d							
Installation method				Connection type							
1 = Metric thread M18x1.5 (flat-bottom flange)				1 = two 4-pin M12 plugs, one 4-pin M8 power connector							
				2 = 2 m standard pigtail cable							
b				3 = 5 m standard pigtail cable							
Measurement blind zone (start/end)				4 = 10 m standard pigtail cable							
1=50.8mm/63.5mm											
2=29mm/60mm											
				e							
c				PN1 = PROFINET RT, standard version, single magnet							
Measuring range				PN2 = PROFINET RT, multi-magnet							
Unit: mm. Pad with leading zeros to four digits,											
increment in 5 mm steps from 0025 to 7600 mm											
Example: 7.1-1-1-0050-1-PN1											
7.1 Series built-in displacement sensor - metric thread M18x1.5 (flat-bottom flange) - zero/dead zone 50.8 mm/63.5 mm - length 50 mm											
Two 4-pin M12 connectors, one 4-pin M12 power connector - PN1 = PROFINET RT, standard version, single magnet											

Series 7.6/Analog Output



- Robust and reliable industrial displacement sensor
- Linear measurement with absolute output
- LED indicator for diagnostics
- Non-contact measurement, no wear Nonlinearity
- Up to 0.01%
- Repeatability up to 0.001%
- External mounting

Product features:

Temperature Range
-40°C~+85°C

EMC

Vibration/Shock Resistance

Absolute Value

Magnetic Field Protection

Quick Removal

High IP Protection Rating

Short-circuit Protection

Reverse Polarity Protection

High Resolution

High-Pressure Resistance
700Bar

Model selection code									
7.6 - X - X X X X - X - X									
a Installation method					c Connection type				
1 = Type C Half-round magnet					1 = 6-pin M16 male plug		5 = 2 m high-temperature cable, pigtail		
2 = Type K Floating magnet (discontinued)					2 = 2 m standard cable, pigtail		6 = 5 m high-temperature cable, pigtail		
3 = Type U Floating magnet (discontinued)					3 = 5 m standard cable, pigtail		7 = 10 m high-temperature cable, pigtail		
4 = Type S Floating magnet					4 = 10 m standard cable, pigtail				
5 = Type M Floating magnet									
6 = Type N Floating magnet					d Output signal				
7 = Type L Floating magnet					A10 = Current 4~20mA		V10 = Voltage 0~10 V		
b Measuring range					A11 = Current 20~4 mA		V11 = Voltage 10~0 V		
Unit: mm. Pad with leading zeros to four digits,					A20 = Current 0~20 mA		V20 = Voltage ~10~10 V		
increment in 5 mm steps from 0025 to 7600 mm					A21 = Current 20~0 mA		V21 = Voltage 10~-~10 V		
Example: 7.6-1-0050-1-A10									
7.6 Series External Displacement Sensor - Type C - Semi-circular Magnet - Length 50 mm - 6-pin M16 Male Plug - Current 4~20 mA									

Project name	Parameter specifications
Measurement parameters	
Measuring range	25~7600mm
Output signal	0~20 mA (minimum/maximum load: 0/500 Ω) 4~20 mA (minimum/maximum load: 0/500 Ω) 0~10 V (minimum load > 5 kΩ) -10~+10V (minimum load >5k Ω)
Resolution	16-bit D/A
Nonlinearity	<±0.01% F.S. (min. ±50 μm)
Repeatability	<±0.001% F.S. (min. ±1 μm)
Update time	0.5 ms (range < 1 m) 1.0 ms (1 m < range < 2 m) 2.0 ms (2 m < range < 4 m) 4.0 ms (4 m < range < 7.6 m)
Electrical characteristics	
Wiring method	Waterproof cable gland or six-pin aviation connector
Input voltage	24VDC(-15/+20%)
Operating current	<50mA (varies with measuring range)
Insulation capability	500V (between signal ground and housing)
Polarity protection	Max -30VDC
Overvoltage protection	Max 36VDC
Fault indication	Red/green dual-color LED indicator

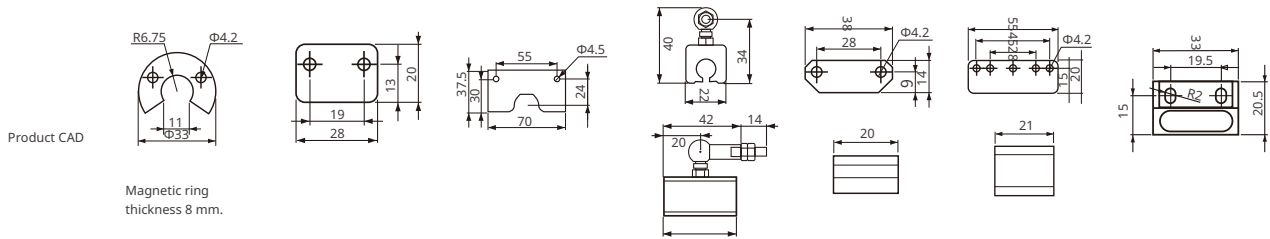
Operating conditions	
Magnet speed	Any
Ambient temperature	-40°C ~ +85°C
Humidity/dew point	Humidity 90%, no condensation
Temperature coefficient	< 30 ppm/°C
Protection rating	IP67

Installation accessories	
Installation orientation	Any
Installation method	Mounting clamp, M5x20 screw
Position magnet	Type C semi-circular magnet, Type K floating magnet, Type U floating magnet

Structural materials	
Sensor head	Aluminum alloy
Outer protective shell	Aluminum alloy
Mounting flange	304L stainless steel

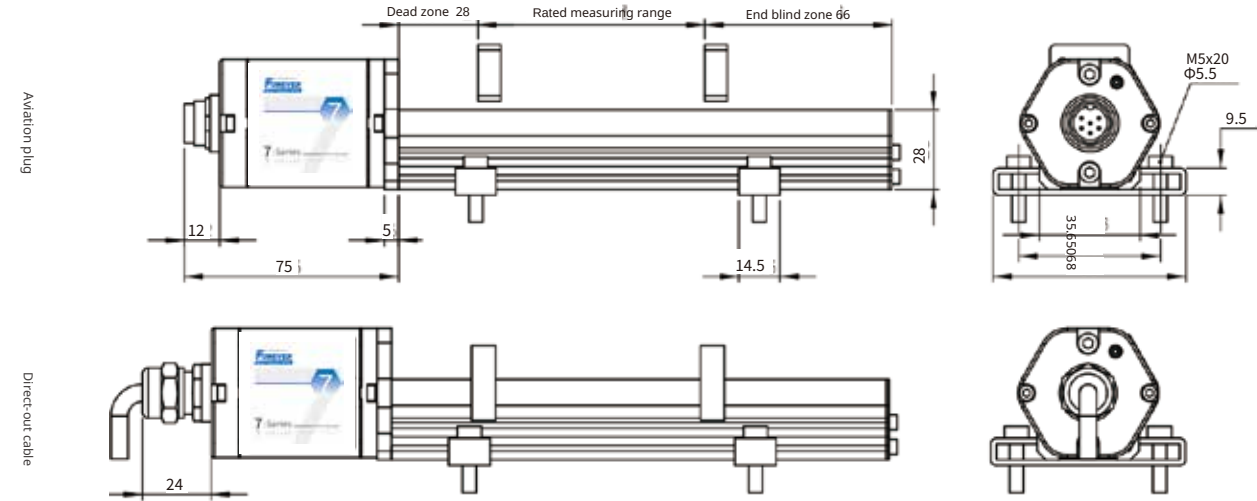
Magnetic Ring

	Type C Half-round magnet	Type K Floating magnet	Type U Floating magnet	Type S Slider magnet	Type M Floating magnet	Type N Floating magnet	Type L Floating magnet
Product image							



Product Applications	Scope of use: Series 7 Operating temperature: -40°C~+85°C Mounting screw: M4x18 Vertical distance: 3±1	Scope of use: Series 7, 4, 3 Operating temperature: -40°C~+85°C Mounting screw: M4x18 Horizontal deviation: ±3 mm Vertical distance: 2~4 mm	Scope of use: Series 7, 3 Operating temperature: -40°C~+85°C Mounting screw: M4x18 Horizontal deviation: ±4 mm Vertical distance: -3.3~4.7mm	Scope of use: Series 7 Operating temperature: -40°C~+85°C Mounting screw: M5	Scope of use: Series 7, 4, 3 Operating temperature: -40°C~+85°C Mounting screw: M4 Horizontal deviation: ±3 mm Vertical distance: 2~4 mm	Scope of use: Series 7, 4, 3 Operating temperature: -40°C~+85°C Mounting screw: M4 Horizontal deviation: ±15 mm Vertical distance: 5~12 mm	Scope of use: Series 7, 4, 3 Operating temperature: -40°C~+85°C Mounting screw: M4x18 Horizontal deviation: ±3 mm Vertical distance: 2~4 mm
----------------------	---	---	--	--	--	--	---

Overall Dimensions

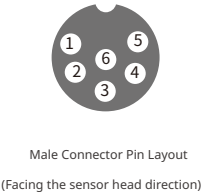


Note: The 7-series products use a floating magnet mounted directly on the moving part and do not contact the sensor.
K-type floating magnet: Maximum permissible lateral offset ±3 mm, maximum permissible vertical gap up to 5 mm.
U-type floating magnet: Maximum permissible lateral offset ±4 mm, maximum permissible vertical gap -3.3 to +4.7 mm.

Wiring diagram

Analog Output Pin Definition

Pin Number	Wire Color	Definition
1	Gray	Analog signal output 1
2	Pink	Signal ground 1 + Signal ground 2
3	Yellow	None
4	Green	Analog signal output 2
5	Brown	+24VDC power supply (-15/+20%)
6	White	DC power ground (0VDC)



Status Indicator

Indicator Light Status	Definition
Green light on	Normal operation
Green light flashing	Programming mode
Red light flashing	Magnet ring out of measuring range
Red light on	Magnet ring not detected or magnet ring damaged



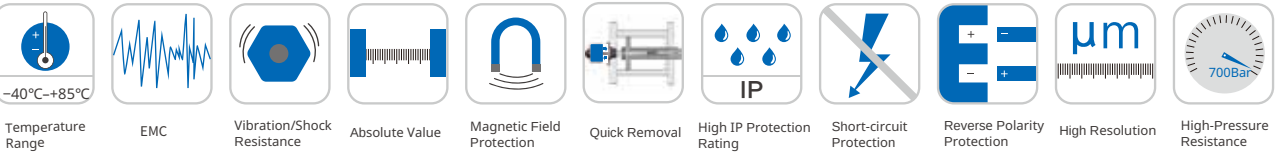
Series 7.6/ SSI output



- Robust and reliable industrial displacement sensor
- Linear measurement, absolute output
- LED indicator for diagnostics
- Non-contact measurement, no wear
- Resolution up to 0.5 μm
- Nonlinearity up to 0.01%
- Repeatability up to 0.001%
- External mounting
- Direct SSI digital output, binary or Gray code
- Real-time sensing, synchronous measurement



Product features:



Model selection code	7.6	-	X	-	X	X	X	X	-	X	-	X	-	X
			a		b	b	b	b		c		d		e

a Installation method		d Output direction	
1 = C-type Semi-circular magnet		1 = forward	2 = Reverse
2 = K-type Floating magnet (discontinued)			
3 = U-type Floating magnet (discontinued)		e Resolution	
4 = S-type Slider magnet		1=0.001 mm	2=0.002mm
5 = L-type Floating magnet		3=0.005mm	4=0.01mm
b Measuring range		5=0.02mm	6=0.05mm
Unit: mm; pad with leading zeros to four digits; increments of 5 mm		7=0.1mm	8=0.0005mm
c Connection type		f Data format	
1 = 7-pin M16 male plug	5 = 2 m high-temperature cable, pigtail	1G = 25-bit Gray code	1B = 25-bit binary
2 = 2 m standard cable, pigtail	6 = 5 m high-temperature cable, pigtail	2G = 24-bit Gray code	2B = 24-bit binary
3 = 5 m standard cable, pigtail	7 = 10 m high-temperature cable, pigtail	3G = 26-bit Gray code	3B = 26-bit binary
4 = 10 m standard cable, pigtail			

Example: 7.6-1-0050-1-1-1-1G

7.6 series external displacement sensor - C-type semi-circular magnet - length 50 mm - 7-pin M16 male connector - output is forward measurement - resolution: 1 μm - 25-bit Gray code

Project name	Parameter specifications
Measurement parameters	
Measuring range	25~7600mm
SSI signal	24-, 25-, 26-bit binary or Gray code
Transmission speed	70kBd~1MBd Cable length: <3 <50 <100<200<400 m
Resolution	0.5/1/2/5/10/20/50/100 μm
Nonlinearity	<±0.01% F.S. (minimum ±40μm)
Repeatability	<±0.001% F.S. (±1 digit)
Update time	Stroke: 300 750 1000 2000 5000 mm Frequency: 3.7 3.0 2.3 1.2 0.5 kHz

Electrical characteristics	
Wiring method	Waterproof connector or 7-pin aviation plug
Input voltage	24VDC(-15/+20%)
Operating current	<60 mA (varies with measuring range)
Insulation capability	500V (between signal ground and housing)
Polarity protection	Max -30VDC
Overvoltage protection	Max 36VDC
Fault indication	Red/green dual-color LED indicator

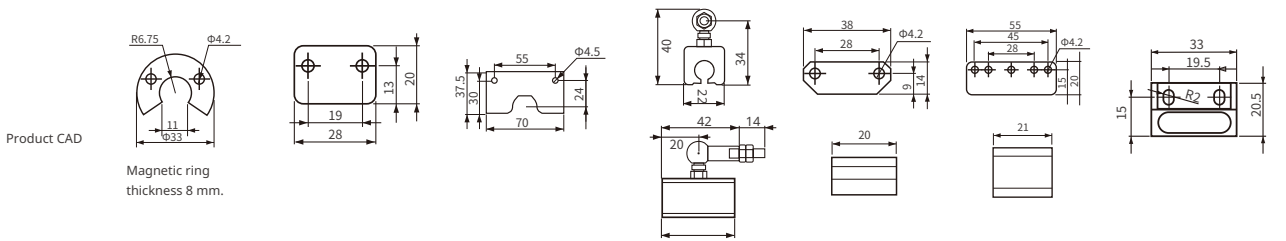
Operating conditions	
Magnet speed	Any
Ambient temperature	-40°C ~ +85°C
Humidity/dew point	Humidity 90%, no condensation
Temperature coefficient	< 30 ppm/°C
Protection rating	IP67

Installation accessories	
Installation orientation	Any
Installation method	Mounting clip, M5x20 dedicated screw
Position magnet	C-type half-round magnetic ring, K-type floating magnet, U-type floating magnet

Structural materials	
Sensor head	Aluminum alloy
Outer protection rod	Aluminum alloy
Mounting flange	304L stainless steel

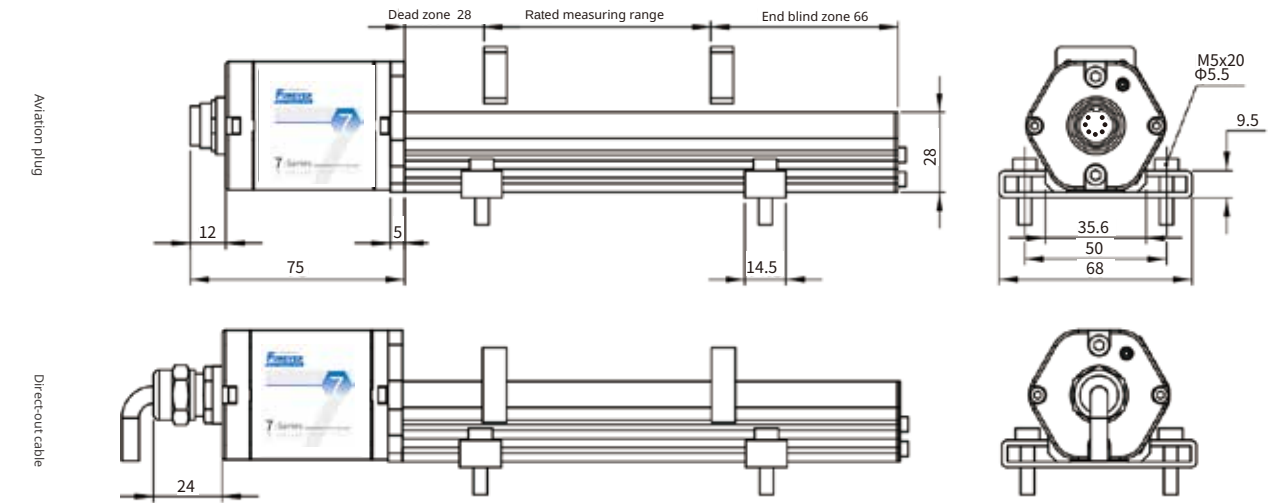
Magnetic Ring

	Type C Half-round magnet	Type K Floating magnet	Type U Floating magnet	Type S Slider magnet	Type M Floating magnet	Type N Floating magnet	Type L Floating magnet
Product image							



Product Applications	Scope of use: Series 7 Operating temperature: -40°C~+85°C Mounting screw: M4x18 Vertical distance: 3±1	Scope of use: Series 7, 4, 3 Operating temperature: -40°C~+85°C Mounting screw: M4x18 Horizontal deviation: ±3 mm Vertical distance: 2~4 mm	Scope of use: Series 7, 3 Operating temperature: -40°C~+85°C Mounting screw: M4x18 Horizontal deviation: ±4 mm Vertical distance: -3.3~4.7mm	Scope of use: Series 7 Operating temperature: -40°C~+85°C Mounting screw: M5	Scope of use: Series 7, 4, 3 Operating temperature: -40°C~+85°C Mounting screw: M4 Horizontal deviation: ±3 mm Vertical distance: 2~4 mm	Scope of use: Series 7, 4, 3 Operating temperature: -40°C~+85°C Mounting screw: M4 Horizontal deviation: ±15 mm Vertical distance: 5~12 mm	Scope of use: Series 7, 4, 3 Operating temperature: -40°C~+85°C Mounting screw: M4x18 Horizontal deviation: ±3 mm Vertical distance: 2~4 mm
----------------------	---	---	--	--	--	--	---

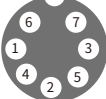
Overall Dimensions



Note: The 7-series products use a floating magnet mounted directly on the moving part and do not contact the sensor.
K-type floating magnet: Maximum permissible lateral offset ±3 mm, maximum permissible vertical gap up to 5 mm.
U-type floating magnet: Maximum permissible lateral offset ±4 mm, maximum permissible vertical gap -3.3 to +4.7 mm.

Wiring diagram

SSI Output Pin Definition



Male Connector Pin Layout
(Facing the sensor head direction)

Pin Number	Wire Color	Definition
1	Gray	Data (-)
2	Pink	Data (+)
3	Yellow	Clock (+)
4	Green	Clock (-)
5	Brown	+24VDC power supply (-15/+20%)
6	White	DC power ground (0VDC)
7	Not connected	

Status Indicator



Indicator Light Status	Definition
Green light on	Normal operation
Green light flashing	Programming mode
Red light flashing	Magnet ring out of measuring range
Red light on	Magnet ring not detected or magnet ring damaged

Series 7.6/PROFINET Output



- Robust and reliable industrial displacement sensor
 - Linear measurement, absolute output
 - LED indicator for diagnostics
 - Non-contact measurement, no wear Nonlinearity
 - up to 0.01%
 - Repeatability up to 0.001%
 - Resolution up to 1 μm
 - External mounting
 - Direct PROFINET output
- Multi-magnet position measurement
- Speed measurement



Product features:

Temperature Range
-40°C~+85°C

EMC

Vibration/Shock Resistance

Absolute Value

Magnetic Field Protection

Quick Removal

High IP Protection Rating

Short-circuit Protection

Reverse Polarity Protection

High Resolution

High-Pressure Resistance

Model selection code

7.6 - X - 1 - X X X X - X - X X X

a

b

c

d

e

a

Installation method

1 = Type C semi-circular magnet

4 = Type S floating magnet

7 = Type L floating magnet

2 = Type K floating magnet (discontinued)

5 = Type M floating magnet

3 = Type U floating magnet (discontinued)

6 = Type N floating magnet

2 = 2-meter standard cable with straight exit

3 = 5-meter standard pigtail cable

4 = 10-meter standard pigtail cable

d

Connection type

1 = Two sets of 4-pin M12 plugs, 1 set of 4-pin M12 power connector

b

Measurement blind zones (start/end)

1 = 28 mm / 66 mm

e

Output

PN1 = PROFINET RT, standard version, single magnet

PN2 = PROFINET RT, multi-magnet

c

Measuring range

Unit: mm. Pad with leading zeros to four digits,

increment in 5 mm steps from 0025 to 7600 mm

Example: 7.6-1-1-0050-1-PN1

Series 7.6 external displacement sensor - Type C semi-circular magnet - zero/dead zones 28 mm / 66 mm - length 50 mm

Two 4-pin M12 connectors, one 4-pin M12 power connector - PN1 = PROFINET RT, standard version, single magnet

Project name	Parameter specifications	
Measurement parameters		
Measuring range	External type: 0025~7600 mm	Built-in type: 25~7600 mm
Interface	Profinet IO RT/IRT	
Data transmission rate	Up to 100 MBit/s	
Resolution	Position: 1~100 μm optional	Speed: 1 mm/s
Nonlinearity	<±0.01% F.S. (min. ±50 μm)	
Repeatability	<±0.001% F.S. (min. ±2.5 μm)	
Update time	Depends on the stroke	
Jitter	<5 μm	
Hysteresis	<4 μm	

Electrical characteristics	
Connector selection	Two 4-pin M12 signal connectors; one 4-pin M8 power connector
Input voltage	24 VDC (-15/+20%)
Power consumption	Typically 110 mA
Insulation capability	500V (between signal ground and housing)
Polarity protection	Max -30VDC
Overvoltage protection	Max 36VDC
Ripple	≤0.28 Vpp

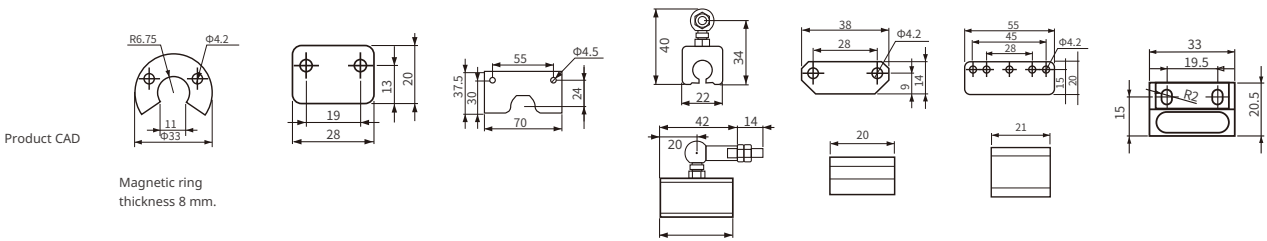
Operating conditions	
Magnet speed	Any
Ambient temperature	-40°C ~ +80°C (up to +85°C) Humidity
Humidity/dew point	90%, no condensation
Temperature coefficient	<15 ppm/°C
Protection rating	IP67
Vibration rating	15 g/100i 2000 Hz/IEC 68-2-6 standard

Installation accessories	
Installation orientation	Any
Installation method	Mounting clamp, M5×20 dedicated screws
Position magnet	C-type semi-circular magnet or floating magnet

Structural materials	
Sensor head	Aluminum alloy
Outer protection rod	304L stainless steel
Mounting flange	304L stainless steel

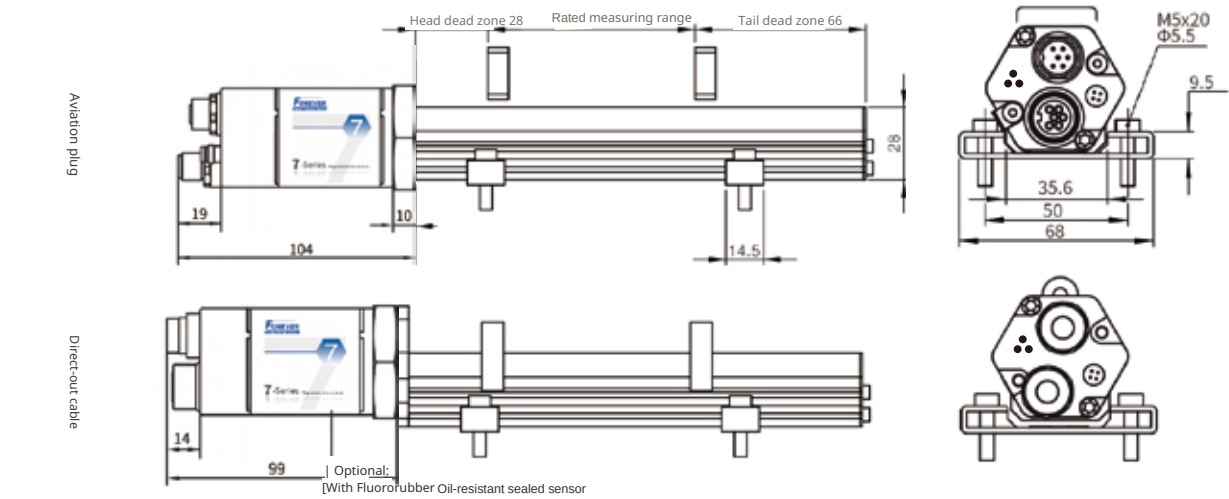
Magnetic Ring

	Type C Half-round magnet	Type K Floating magnet	Type U Floating magnet	Type S Slider magnet	Type M Floating magnet	Type N Floating magnet	Type L Floating magnet
Product image							



Product Applications	Scope of use: Series 7 Operating temperature: -40°C~+85°C Mounting screw: M4x18 Vertical distance: 3±1	Scope of use: Series 7, 4, 3 Operating temperature: -40°C~+85°C Mounting screw: M4x18 Horizontal deviation: ±3 mm Vertical distance: 2~4 mm	Scope of use: Series 7, 3 Operating temperature: -40°C~+85°C Mounting screw: M4x18 Horizontal deviation: ±4 mm Vertical distance: -3.3~4.7mm	Scope of use: Series 7 Operating temperature: -40°C~+85°C Mounting screw: M5	Scope of use: Series 7, 4, 3 Operating temperature: -40°C~+85°C Mounting screw: M4 Horizontal deviation: ±3 mm Vertical distance: 2~4 mm	Scope of use: Series 7, 4, 3 Operating temperature: -40°C~+85°C Mounting screw: M4 Horizontal deviation: ±15 mm Vertical distance: 5~12 mm	Scope of use: Series 7, 4, 3 Operating temperature: -40°C~+85°C Mounting screw: M4x18 Horizontal deviation: ±3 mm Vertical distance: 2~4 mm
----------------------	---	---	--	--	--	--	---

Overall Dimensions



Note: The 7-series products use a floating magnet mounted directly on the moving part and do not contact the sensor.
K-type floating magnet: Maximum permissible lateral offset ±3 mm, maximum permissible vertical gap up to 5 mm.
U-type floating magnet: Maximum permissible lateral offset ±4 mm, maximum permissible vertical gap -3.3 to +4.7 mm.

Wiring diagram

PROFINET Output Pin Definition (Facing the sensor head direction)

Signal	Pin Number	Wire Color	Function
	1	Yellow	Tx+
	2	White	Rx+
	3	Orange	Tx-
	4	Blue	Rx-

Power supply	Pin Number	Wire Color	Function
	1	Brown	+24VDC (-15/+20%)
	2	White	n.c.
	3	Blue	0V (GND)
	4	Black	n.c.

Fluid Sensors



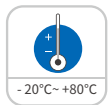
Liquid Level and Temperature Sensor LT Series



- Easy to read, rugged LED digital display
- Brand-new design, multifunctional applications
- Intelligent menu, configurable transmitter output range Continuously
- Adjustable switch points, easy to use Temperature/level: 4 switch outputs, 2
- Analog signal outputs



Product features:



Temperature Range



EMC



Vibration/Shock resistance



Magnetic field protection



High IP protection rating



Short-circuit protection



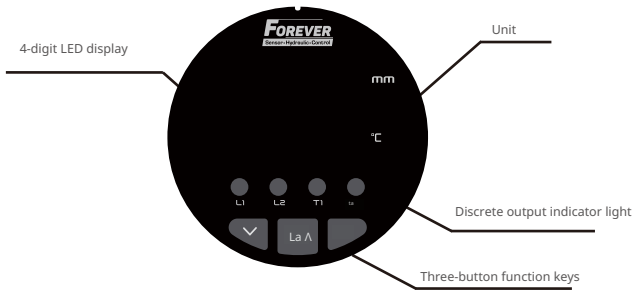
Reverse polarity protection



RS485

Product Principle

LT series electronic integrated level/temperature sensors can output multiple signals simultaneously, meeting monitoring needs for level and temperature in different settings while reducing the number of openings on the user's enclosure. The simplified, miniaturized design and attractive appearance meet equipment upgrade requirements (PNP/NPN/0...20mA/4...20mA), with full-range scalable analog output.



Product Applications

- Machine Tool
- Hydraulic and Pneumatic Systems
- Pumps and Compressors
- Machinery Manufacturing
- Automation Equipment

Output signal

Measurement	Switching Output		Analog Output
Liquid Level	OUT1	OUT2	4...20mA
	PNP/NPN	PNP/NPN	
Temperature	OUT3	OUT4	4...20mA
	PNP/NPN	PNP/NPN	

Model selection code	LT	-	X	-	0	3	5	0	-	X	-	X
			a		b	b	b	b		c		d

a	Output type	c	Float type
	1: Analog 4-20 mA 2: Analog 0-10 V (planned)		1: NBR float (for oil) 2: 304 float (for water)
	3: RS485 (Modbus RTU) 4: IO-Link (planned)		d
b	Measuring range		Switch type
	100mm-2000mm, order in 50mm increments		1: PNP output (factory default is PNP, can be switched to NPN via parameters)
			2: NPN output (factory default is NPN, can be switched to PNP via parameters)
			Default: RS485

*Cables must be ordered separately; optional straight-head cables of 2 m, 5 m, 10 m, 15 m, 20 m, 25 m: *If an analog 0-10 V output is required, you can use Forever FAD-2CH-12V signal conversion module for conversion

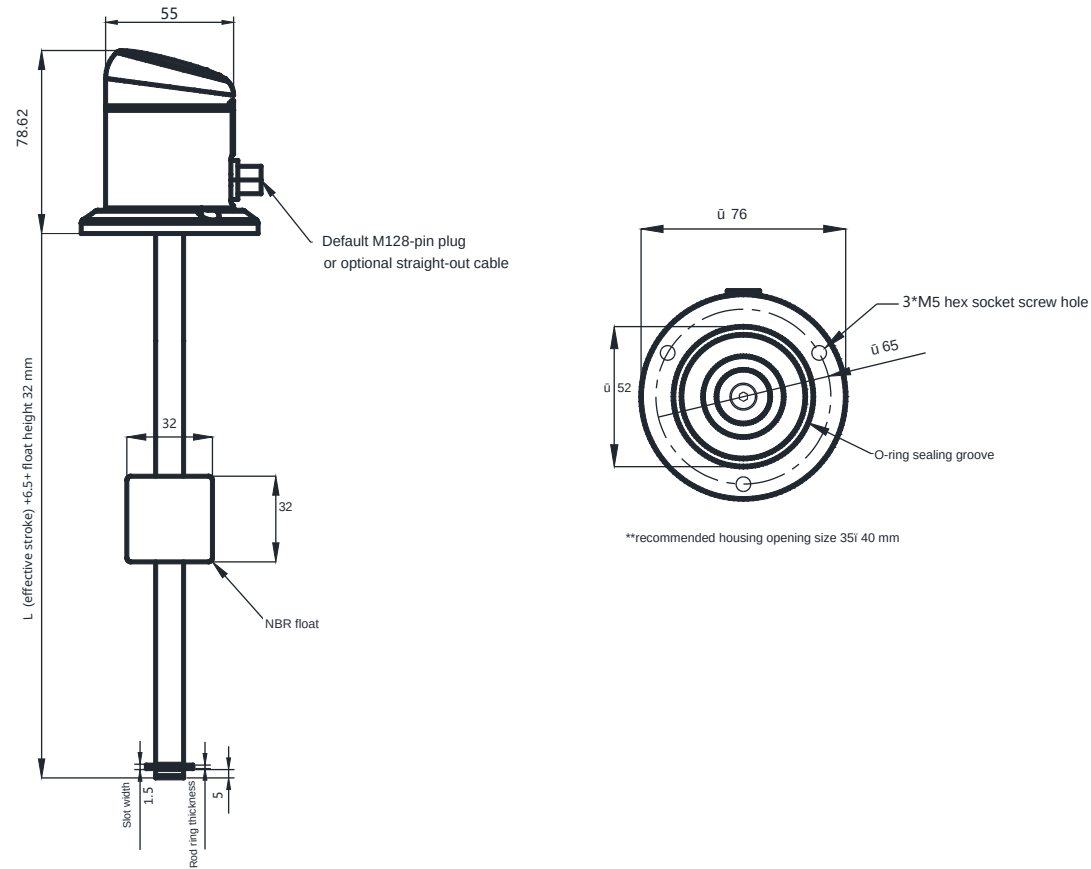
Analog version:			RS485 version:		
2m	CT-M12F-0802	5m	2m	CT-P12LD0502	5m
CT-M12F-0805	10m	CT-	CT-P12LD0505	10m	CT-
M12F-0810	15m	CT-	P12LD0510	15m	CT-
M12F-0815	20m	CT-	P12LD0515	20m	CT-
M12F-0820	25m	CT-	P12LD0520	25m	CT-
M12F-0825			P12LD0525		



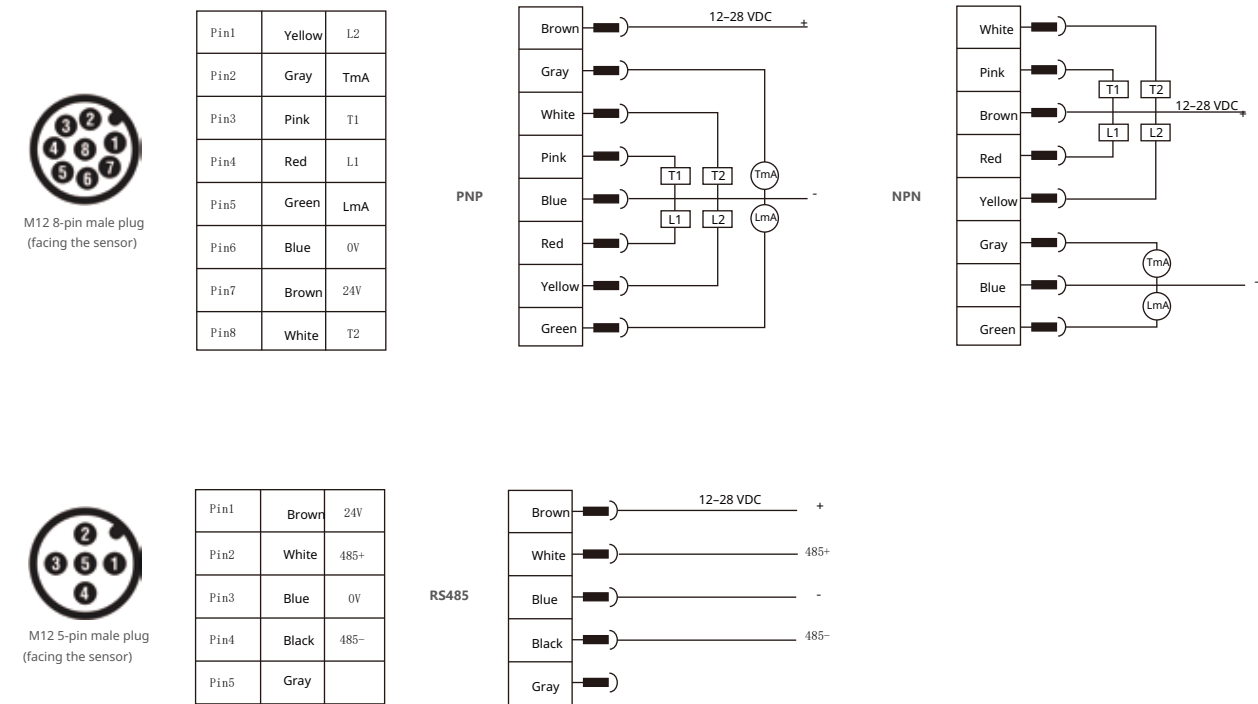
Example: LT-1-0350-1-1
LT level and liquid temperature sensor - analog 4-20 mA - length 350 mm
M12 8-pin connector, - NBR float (for oil) - PNP output (factory default PNP, can be switched to NPN via parameters)

Technical parameters	Parameter specifications
Power supply	DC12...28V
Current consumption	Maximum 600 mA, including switching current
Connection	8-core pigtail/M12 8-pin male plug
Safety	Short-circuit protection, reverse polarity protection (-36 V Max)
Insulation	DC 500 V
Overvoltage	DC 36V
Turn-on time	2s
Switching function	NO/NC switchable at will
Switching current	400 mA Max
Response time	Switching output/analog signal ≤ 5 ms
Load	Analog signal 4...20 mA ≤ 500 Ω
Service life	50 million switching cycles
Typical level measurement accuracy	10mm
Long-term level drift	5mm
Typical temperature measurement accuracy	±1°C
Medium temperature	-20...80°C
Ambient temperature	-20...80°C
Storage temperature	-20...65°C
Relative humidity	-45...75%
Vibration resistance	20 g, 10...2000 Hz (compliant with IEC60068-2-6)
Shock resistance	50 g, 6 ms (compliant with IEC60068-2-27)
Protection rating	IP67
Wetted parts	304 linkage/NBR float
Housing	Aluminum alloy with anodized
Electrical connection	Treatment PVC/PUR (customizable)

Dimension drawing (mm)



Wiring diagram



Digital Temperature Sensor TS Series



- Easy to read, LED numeric display
- Brand-new design, multi-functional applications
- Intelligent menu
- Continuously adjustable switch points, easy to use
- 2 switch outputs, 1 analog current output

Product features:

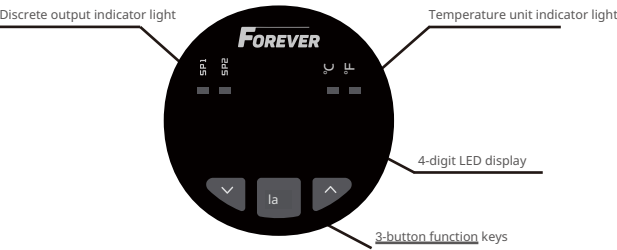


Product Principle

The TS Series digital temperature sensors use high-precision PT100 for temperature measurement, with the raw signal processed by a constant-current source circuit and converted into a standard analog output. An anodized housing design with high-brightness LED numeric display. The three-button design and menu make the product easier to use. Multiple mechanical interfaces can fully meet various specific installation requirements, and a body that can rotate 330° ensures an optimal viewing angle under different installation methods.

Product Applications

Machine Tool
Hydraulic and Pneumatic Systems
Pumps and Compressors
Machinery Manufacturing
Automation Equipment



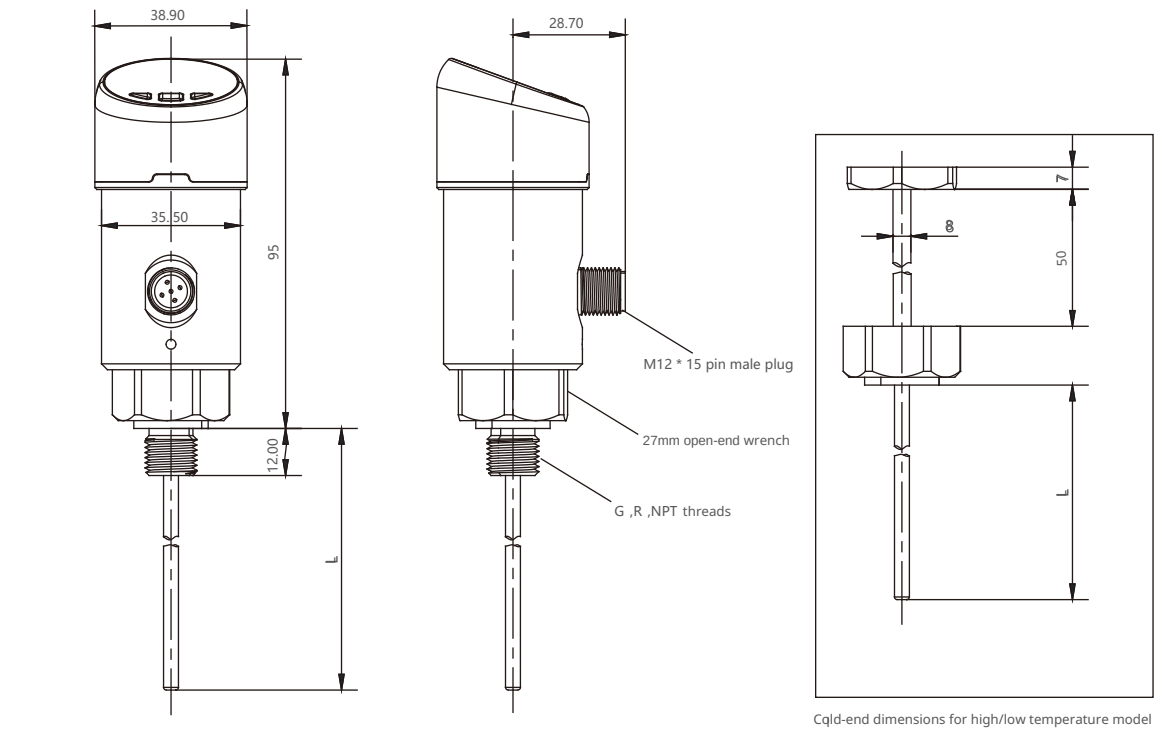
Output signal

Measurement	Switching Output		Analog Output
Pressure	OUT1	OUT2	4-20mA/0-10V
	PNP/NPN	PNP/NPN	Optional Ordering

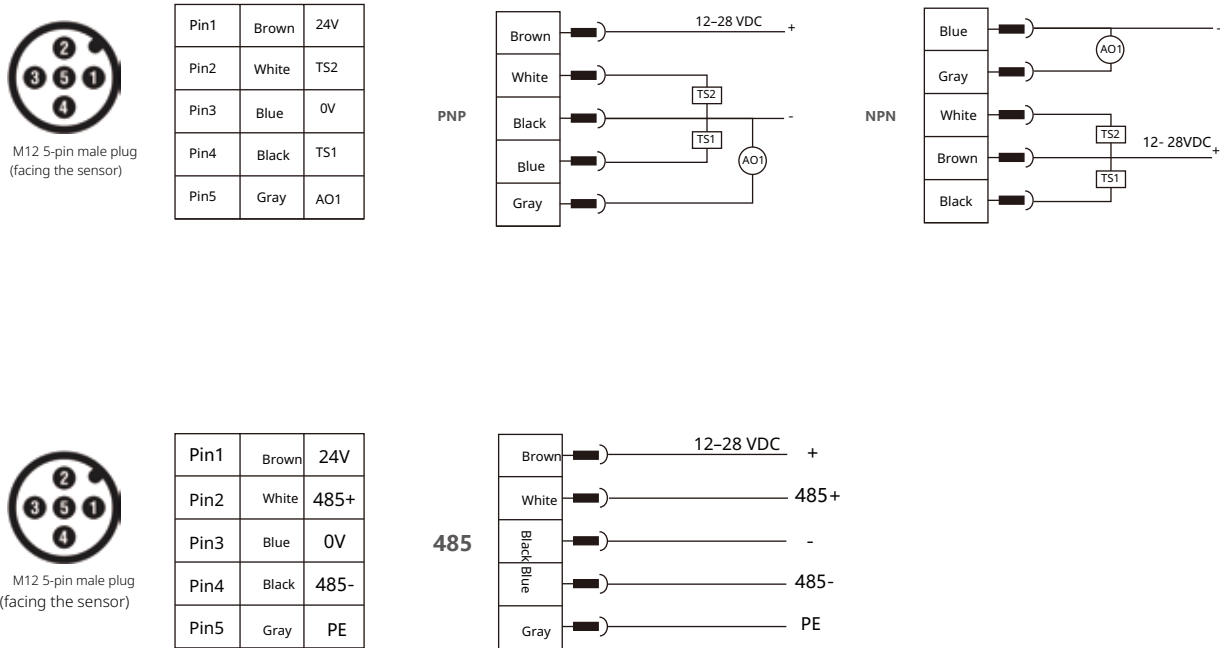
Model selection code																					
TS-		X	-	X	-	0	2	5	0	-	X	-	X	-	X						
		a					b					c			d			e			f
a Connection type										d Probe rod diameter											
1 = G1/4 male thread				2 = G1/2 male thread				1: 6mm diameter stainless steel 304 probe rod 2: 8mm diameter stainless steel 304 probe rod													
3 = R1/4 male thread				4 = NPT1/4 male thread				e Output type													
b Measuring range										1: Current 4-20 mA (factory default is current; can be switched to voltage via parameters)											
1: Range -20...80°C (range can be specified by modifying parameters)										2: Voltage 0-10 V (factory default is voltage; can be switched to current via parameters)											
2: Range 0...100°C (parameters can be modified to specify the range)										3: RS485 (RS485 output only, Modbus RTU protocol)											
3: Range -50...200°C high/low-temperature type (parameters can be modified to specify the range) requires matching cold junction																					
4: Range -50...400°C high/low-temperature type (parameters can be modified to specify the range) requires matching cold junction																					
5: Range -100...100°C high/low-temperature type (parameters can be modified to specify the range) requires matching cold junction																					
6: Range -200...100°C high/low-temperature type (parameters can be modified to specify the range) requires matching cold junction																					
c Probe rod length, in mm; the length includes the connection thread length. For example, 025 indicates the probe rod length including the threaded section is 25mm.																					
*Cables need to be ordered separately; options include 2m, 5m, 10m, 15m, 20m, 30m straight/angled cables																					
f Straight head:		2m CT-P12LD0502	15m CT-P12LD0515		2m CT-P12SD0502	15m CT-P12SD0515															
		5m CT-P12LD0505	20m CT-P12LD0520		5m CT-P12SD0505	20m CT-P12SD0520															
		10m CT-P12LD0510	30m CT-P12LD0530		10m CT-P12SD0510	30m CT-P12SD0530															

Technical parameters	Parameter specifications
Power supply	DC12...28V
Current consumption	With 24V DC power supply, the no-load current consumption is 30mA
Connection	M12 5-pin male connector
Safety	Short-circuit protection, reverse polarity protection (-36 V Max)
Insulation	DC 500 V
Overvoltage	DC 36V
Turn-on time	1s
Switching function	PNP/NPN, NO/NC switchable at will
Switching current	200mA Max
Response time	Switching output/analog signal ≤ 5 ms
Load	Analog signal 4...20 mA ≤ 500 Ω
Service life	50 million switching cycles
Measurement accuracy	≤ ±0.5°C
Long-term drift	≤ ±0.5%F.S
Medium temperature	-20...100°C (short probe) -200...400°C (long probe)
Ambient temperature	-20...80°C
Storage temperature	-30...80°C
Relative humidity	45...75%
Vibration resistance	20 g, 10...2000 Hz (compliant with IEC60068-2-6)
Shock resistance	50 g, 6 ms (compliant with IEC60068-2-27)
Protection rating	IP67
Wetted parts	304 stainless steel
Housing	304 stainless steel
Electrical connection	PVC/PUR (customized)

Dimension drawing (mm)



Wiring diagram



Digital Display Pressure Sensor PS Series



- Easy to read, LED numeric display
- Brand-new design, multi-functional applications
- Intelligent menu
- Continuously adjustable switch points, easy to use
- 2 switch outputs, 1 analog current output

Product features:



Temperature Range



EMC



Vibration/Shock resistance



Magnetic field protection



High IP protection rating



Short-circuit protection



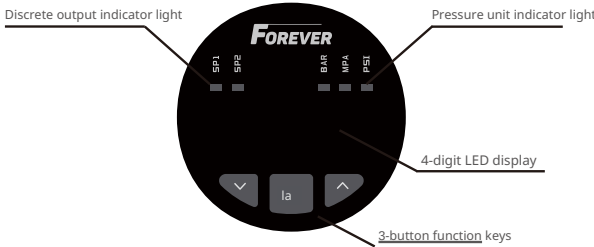
Reverse polarity protection



RS485

Product Principle

The PS series digital display pressure sensors feature a high-protection-grade design and use a diffused silicon core for pressure measurement. The raw signal is processed by a constant-current source circuit and converted into a standard analog output. The anodized housing, high-brightness LED digital display, three-button design, and menu make the product easier to use. Multiple mechanical interfaces meet various specific installation needs. The body can rotate 330°, ensuring an optimal viewing angle under different installation methods.



Output signal

Measurement	Switching Output		Analog Output
Pressure	OUT1	OUT2	4-20mA/0-10V
	PNP/NPN	PNP/NPN	Optional Ordering

Product Applications

- Machine Tool
- Hydraulic and Pneumatic Systems
- Pumps and Compressors
- Machinery Manufacturing
- Automation Equipment

Model selection code			
PS	X	0250	X-X
a	b	b	b
a Connection type		d Switching output type	
1 = G1/4 male thread		2 = G1/2 male thread	5 = NPT 1/4 external thread
3 = M20×1.5 male thread		4 = G1/4 female thread	2: NPN (default from factory is NPN, can be switched to PNP via parameters) Default: RS485
b Measuring range			
1: N01 Measuring range: -1...1 Bar 2: N03 Measuring range: -1...3 Bar 3: N05 Measuring range: -1...5 Bar 4: N10 Measurement range: -1...10 Bar			
5: N25 Measurement range: -1...25 Bar 6: N40 Measurement range: -1...40 Bar 7: 010 Measurement range: 0...10 Bar 8: 025 Measurement range: 0...25 Bar			
9: 060 Measurement range: 0...60 Bar 10: 100 Measurement range: 0...100 Bar 11: 160 Measurement range: 0...160 Bar 12: 250 Measurement range: 0...250 Bar			
13: 400 Measurement range: 0...400 Bar 14: 600 Measurement range: 0...600 Bar 15: 1000 Measurement range: 0...1000 Bar			
c Analog/Communication Types			
1: Current 4-20 mA (factory default is current; can be switched to voltage via parameters) 2: Voltage 0-10 V (factory default is voltage; can be switched to current via parameters)			
3: RS485 (RS485 output only, Modbus RTU protocol) 4: IO-Link (under development)			
*Cables need to be ordered separately; options include 2m, 5m, 10m, 15m, 20m, 30m straight/angled cables			
Straight head: 2m CT-P12LD0502 5m CT-P12LD0505 10m CT-P12LD0510 15m CT-P12LD0515 20m CT-P12LD0520 30m CT-P12LD0530 Angled head: 2m CT-P12SD0502 5m CT-P12SD0505 10m CT-P12SD0510 15m CT-P12SD0515 20m CT-P12SD0520 30m CT-P12SD0530			

Technical parameters	Parameter specifications
Power supply	DC12...28V
Current consumption	With 24V DC power supply, the no-load current consumption is 30mA
Connection	M12 5-pin male connector
Safety	Short-circuit protection, reverse polarity protection (-36 V Max)
Insulation	DC 500 V
Overvoltage	DC 36V
Turn-on time	1s
Switching function	PNP/NPN, NO/NC switchable at will
Switching current	200mA Max
Response time	Switching output/analog signal ≤ 5 ms
Load	Analog signal 4...20 mA ≤ 500 Ω
Service life	50 million switching cycles
Measurement accuracy	≤ ±0.5%F.S
Long-term drift	≤ ±0.3% F.S.
Medium temperature	-20...80°C
Ambient temperature	-20...80°C
Storage temperature	-30...80°C
Relative humidity	45...75%
Vibration resistance	20 g, 10...2000 Hz (compliant with IEC60068-2-6)
Shock resistance	50 g, 6 ms (compliant with IEC60068-2-27)
Protection rating	IP67
Wetted parts	304 stainless steel
Housing	304 stainless steel
Electrical connection	PVC/PUR (customized)

KS Pressure Sensor



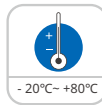
KS Pressure Sensor



- 1. Patented technology—stainless-steel thick-film technology.
- 2. Higher accuracy than similar products, with nonlinearity as low as 0.15%.
- 3. High impact resistance; burst pressure can reach 4 times the rated pressure.
- 4. Fast response time: <1 ms.
- 5. Very long service life; can operate continuously at a high impact frequency of 0.5 Hz for over 3, 000,000 cycles.
- 6. Low temperature drift with a wide compensation range, -20°C to 85°C.
- 7. EMC: strong immunity to electromagnetic interference.
- 8. High cost performance, short lead time, and common stock available from inventory, 2, 4, 16, 40, 250, 400, 1000 bar

The KS pressure transmitter primarily measures the pressure of oil, air, and hydraulic circuits, and can also be used in technical and process measurements such as hydraulic systems, hydraulic vulcanizers, and air compressors. It is equally suitable for harsh conditions with high shock and high vibration.

Product features:



Temperature Range



EMC



Vibration/Shock resistance



Magnetic field protection



High IP protection rating



Short-circuit protection



Reverse polarity protection



RS485



Stainless steel thick-film technology

Model selection code								
KS- X a - X b X c X d -M-V-530								
a Signal output					d Measuring range (bar)			
1=C: 0.1...10.1 Vdc 3=N: 0...10 Vd					N03U	-1+3	B25U	25
2=E: 4...20 mA					N05U	-1+5	B04D	40
b Mechanical connection					B01U	1	B06D	60
1=E:G 1/4 external thread connection (DIN 3852-E)					B1V6	1.6	B01C	100
1=3:G 1/4 external thread connection (DIN 3852-E)					B02U	2	B07C	700
c Electrical connection					B2V5	2.5	B16D	160
1 = C: 4-pin connector (P8)					B04U	4	B02C	200
2=Z: 4-pin connector M12X1					B06U	6	B25D	250
3=E: 4-pin connector (P18)					B01D	10	B04C	400
4=F: shielded cable output					B16U	16	B06C	600
					B02D	20	B01M	1000

Example: KS - E - E - C - B04C - M - V

Project name	Parameter speci ications	
Measurement parameters		
Output signal	Voltage	Current
Nonlinearity (BFSL)	±0.15% FS (typical) ±0.25% FS (maximum)	
Hysteresis	+0.1% FS (typical) +0.15% FS (maximum)	
Repeatability	±0.025% FS (typical) ±0.05% FS (maximum)	
Zero offset error	±0.15% FS (typical) ±0.25% FS (maximum)	
Span offset error	±0.15% FS (typical) ±0.25% FS (maximum)	
Accuracy at room temperature (1)	< ±0.5% FS	
Pressure range (2)	1–1000 Bar (see table)	
Resolution	Infinity	
Overpressure (no performance degradation)	See table	
Pressure safety housing (burst test)	See table	
Pressure medium	Fluids compatible with stainless steel AISI 430F and 17-4 PH	
Housing	Stainless steel AISI 304	
Power supply	15...30Vdc	10...30Vdc
Dielectric strength	250Vdc	
Zero output signal	0 V (N); 0.1 V (C)	4 mA(E)
Full-scale output signal	10 V (N); 10.1 V (C)	20mA(E)
Permissible load	≥5KΩ	See load table
Long-term stability	< 0.2% FS/year	
Operating process temperature range	-40...+125°C (-40...+257°F)	
Operating ambient temperature range	-40...+105°C (-40...+221°F)	
Compensated temperature range	-20...+85°C (-40...+185°F)	
Storage temperature range	-40...+125°C (-40...+257°F)	
Temperature effect of compensation range (zero)	±0.01% FSO/°C typical (±0.02% FSO/°C max)	
Temperature effect of compensation range (span)	±0.01% FSO/°C typical (±0.02% FSO/°C max)	
Response time (10...90% FSO)	< 1 msec	
Warm-up time (3)	< 30 sec	
Mounting position effect	Negligible	
Humidity	Up to 100% relative humidity (RH) without condensation	
Weight	80-120g (nominal)	
Mechanical shock	100g/11msec according to IEC 60068-2-27	
Vibration	20g max 10...2000Hz according to IEC 60068-2-6	
Protection rating	IP65/IP67	
Output short-circuit and reverse polarity protection	Supported	
CE certification	According to EC Directive 2004/108/CE	

FS = Full Scale
1 Includes nonlinearity, hysteresis, repeatability, zero offset, and span shift (according to IEC 61298-2)
2 Operating pressure range from 0.5% to 100% FS
3 Time required to reach rated performance

Pressure range

Measuring range (Bar)	-1 / ±3	-1 / ±5	1	1.6	2	2.5	4	6	10	16	20	25	40	60	100	160	200	250	400	600	1000
Overpressure (Bar)	6	10	6	6	6	10	10	20	20	32	40	50	80	120	200	320	400	500	800	1200	1200
Rupture (Bar)	12	20	9	9	9	15	15	30	40	64	80	100	160	240	400	640	800	1000	1500	1500	1500

Installation Diagram

Dimensions: mm (millimeters)

Connector EN 175301-803 Form A

E-type connector plug

Connector EN 175301-803 Form C

C-type connector plug

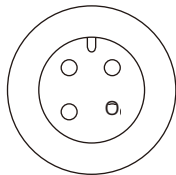
Connector M12x1

Z-type connector plug

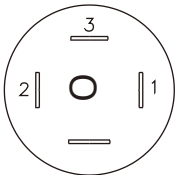
Dimensions in mm [inches]

ELECTRICAL CONNECTION - Connectors

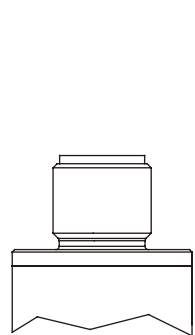
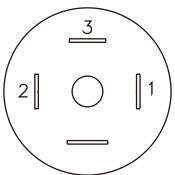
Z-type female plug M12 x 1



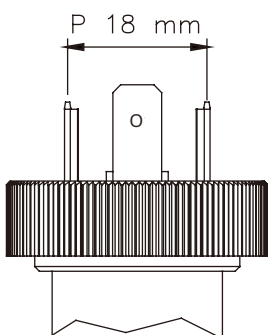
E-type connector plug



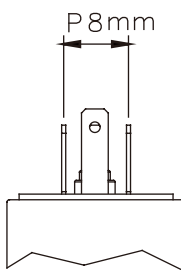
C-type connector plug



4-pin Series 713 male connector, IP67 protection



4-pin male connector DIN A, protection IP65



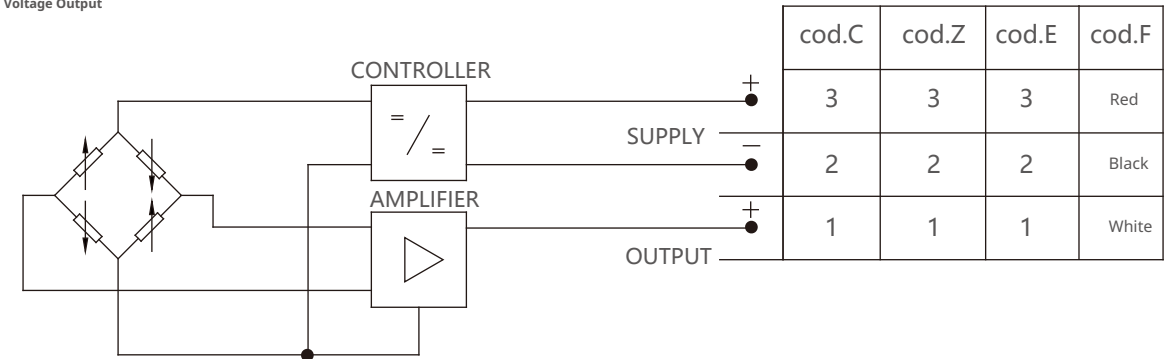
4-pin male connector DIN C, protection IP65

KS Series			
Signal output	4-20mA	Pressure range	0-400bar
Pressure connection	D1/4 male pressure fitting (DIN3852-E)	Linear accuracy	±0.25%FS
Electrical connection	micrDIN	Response time	1msec

ELECTRICAL CONNECTION - Connection diagrams

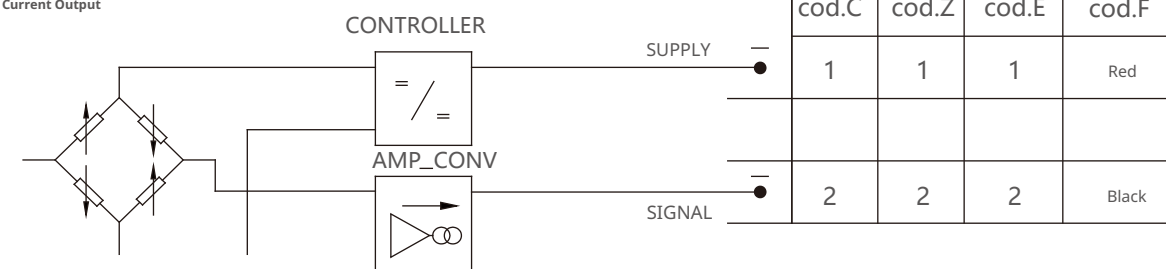
VOLTAGE AMPLIFIED OUTPUT - mod. N

Voltage Output



CURRENT AMPLIFIED OUTPUT - mod. E

Current Output

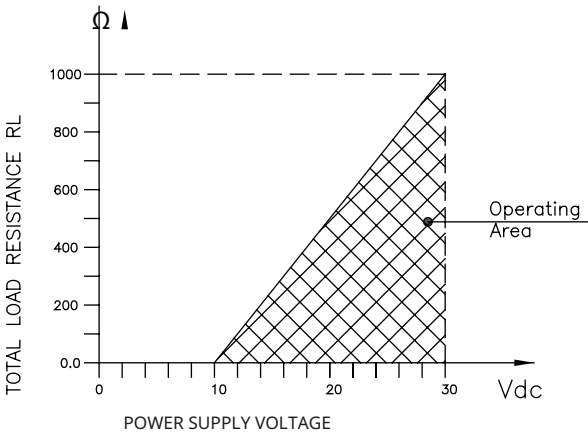


EXTENSION CABLES Extension cable

IP67 female connector M12 x 1 + 2 m cable IP67 female connector M12 x 1 + 5 m cable IP67 female connector M12 x 1 + 10 m cable IP67 female plug M12 x 1 + 15 m cable	CT-P12LD0402 CT-P12LD0405 CT-P12LD0410 CT-P12LD0415	Cable color code	
		Pin	Wire
		1	Brown
		2	White
		3	Blue
		4	Black

Load diagram

Current output

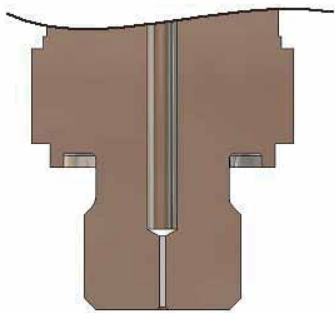


Pressure peak protection value

In many industrial applications, especially in hydraulic systems, dangerous phenomena such as cavitation, liquid hammer, or pressure spikes may occur, for example due to pump start-up and shutdown or rapid valve closure. These phenomena can damage the transmitter.

On request, KS series transmitters are equipped with an integrated pressure snubber. A through hole with a diameter of 0.5 mm helps eliminate harmful spikes to protect the transmitter.

Please contact Gefran to customize different versions of the pressure snubber.



SIL certification (Safety Integrity Level) - Functional safety

Safety is a critical requirement, especially for machine manufacturers. The new EU Directive 2006/42/EC stipulates all relevant essential requirements.

In the context of functional safety, the technical standard IEC/EN 62061 "Safety of machinery — Safety-related functional safety and safety-related electrical, electronic and programmable electronic control systems (SRECS)" regards the EU Directive as a presumption of conformity standard.

KS pressure transmitters have obtained SILCL2 certification from the German certification body TÜV Group, with the test report numbered FS28712235. Under this standard, the transmitter can be used in applications with "high demand mode" and can also be used in mechanical SRECS systems, where fluid pressure will serve as the safety control variable.

Note: 1) SIL certification is standard and can be used for pressure ranges of 0...4 bar and above
2) For voltage-amplified output models, SIL certification applies only to the atmospheric pressure version with an output greater than zero volts (i.e., 0.1...10.1 V)
3) For the full specifications, installation methods, and user manual of KS certified to SIL 2, you can log in directly to www.gefran.com to download

Order accessories as required

Connector plug		
E connection		
EN 175301-803 4-pin DIN A type (P 18) - protection rating IP65		CON 064
Z connection		
4-pin connector M12x1 - Protection rating IP67		370618
C connection		
EN 175301-803 4-pin MicroDIN Type C (P 8) - Protection rating IP65		CON 047

8008A Pressure Gauge



8008A Pressure Gauge



Product Features

- Meets EN837-1 and ASME B40.100 standards
- Corrosion-resistant stainless steel housing
- Dry gauges can be filled with oil on site
- Dry gauges come standard with Flutter guard damped movement
- Customizable dial plate
- Oil-fill plug with venting function
- Multiple panel-mount flanges available
- Robust construction
- Economical and durable
- Customer customization

Typical applications

- Hydraulic systems
- Hydraulic hand tools
- Injection molding equipment
- Pressure washing and spray systems
- Painting equipment
- Compressors
- Irrigation equipment

Detailed specifications

Accuracy 63mm:	±1.6% of full scale (EN837-1) ±1% of full scale (EN837-1) ±2-1-2% of full scale (ASME B40.100, Grade A)
100mm:	±1% of full scale (EN837-1)
Dimensions	63 mm (2 1/2"); 100 mm (4")
Measuring range	Vacuum, compound, 0.1–100 MPa bar, kPa ,MPa,kg/cm ² (single/double scale)
Working pressure	Steady: 75% of full scale Fluctuating: 80% of full scale Short-time: full scale
Wet-contact materials	
Bourdon tube	Copper (vacuum -60 MPa and linkage) 316L stainless steel (70–100 MPa)
Process connection	Copper
Damping pin	Copper, 0.013" orifice (standard)
Non-contact fluid material	
Dial glass	Polycarbonate, glass, or safety glass
Dial Panel	White background with black lettering;aluminum
Pointer	Black; aluminum
Movement	Copper
Housing	304 stainless steel
Bezel	304 stainless steel, reduced neck
Process connection orientation	63 mm: radial and central axial connection 100 mm: radial and eccentric axial
Process connection size	1/8 NPT, 1/4NPT, G1/4B, 1/4BSPT, SAE-4 7/16 -20, 1/2/TPN, G1/2B, M20, 1/4BSPT
Filled with liquid	Glycerin, Silicone oil

Medium temperature	Dry gauge -40°C–70°C glycerin -20°C–70°C silicone oil -40°C–70°C
Ambient temperature	-40°C–70°C
Storage temperature	-40°C–70°C
Temperature Influence	±0.04% of full scale per °C Reference temperature 20°C
Protection rating	IP66 and NEMA 4
Certificate of Approval	RoHS PED; REACH; CRN Listed Ontario; IP66; NEMA 4
Overpressure/Safe Pressure	Range ≤ 10 MPa; 25% full-scale overpressure 10 < Range ≤ 60 MPa; 15% full-scale overpressure 60 < Range ≤ 100 MPa; 10% full-scale overpressure
Optional Features	Customer-customized dial Optional special process connection 0.007", 0.020", 0.063" orifice damping pins optional Panel mounting kits optional (U-clamp and front flange) Special packaging

Model selection code Pressure Gauge 63 - 8008 X 4 X - X - X - X - X - X - X - 10BR

63-Dimensions

63 = 63-63 mm	8008-Type
100 = 100-100 mm	8008-Pressure Gauge

Wet-contact materials

4 Housing Material

A = A - Copper Bourdon tube, copper fittings (vacuum to 60 MPa and combined range)

4=4-304 Stainless Steel

316L stainless steel Bourdon tube; copper fittings (70–100 MPa)

C Process connection size

Filling liquid (please consult the factory for low-temperature environments)

01 - 1/8 NPT Male (only applicable to 63 mm)

F = dry gauge with Flutterguard™ damping movement

02 - 1/4 NPT Male

G=Glycerin

04 - 1/2 NPT Male (only applicable to 100 mm)

S=Silicone oil

13 - G1/4 B Male

N=Dry gauge without silicone oil

15 - G1/2 B Male (only applicable to 100 mm)

T = dry gauge with silicone-free dry-type anti-vibration

16 - M20 x 1.5 Male

Process connection position

41-M14X1.5Male

L - Radial

KA - 1/4 BSPT

B - Eccentric axial (only applicable to 100 mm)

RW - SAE-4 7/16-20

C - Center axial (only applicable to 63 mm)

T - Top

e Glass material

E - Left side at the 9 o'clock position

P - Polycarbonate

D - Right side at the 3 o'clock position

R - Regular glass

S - Safety glass

Housing mounting

g Accuracy Class

0 - Direct mount

J - ±1% full scale (EN837-1)

1 - U-shaped clamp

L - ±1.6% full scale (EN837-1)

2 - Front flange

M - +2-1-2% full scale (ASME B40.100 Grade A)

4 - Front flange and U-shaped clamp

h 10BR Range

5-Hole-Free Flat Flange and U-shaped Clamp

10BR (see range table for details)

6 - Flat flange with holes

7 - Flat flange with holes and U-shaped clamp

Options

WP - Cancel damping pin

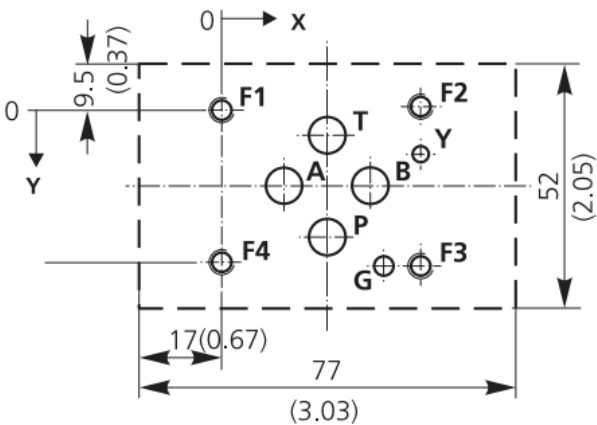
T4 - 0.007" orifice damping pin

T7 - 0.020" orifice damping pin

T8 - 0.031" orifice damping pin

T9 - 0.063" orifice damping pin

Mechanical mounting interface diagram:

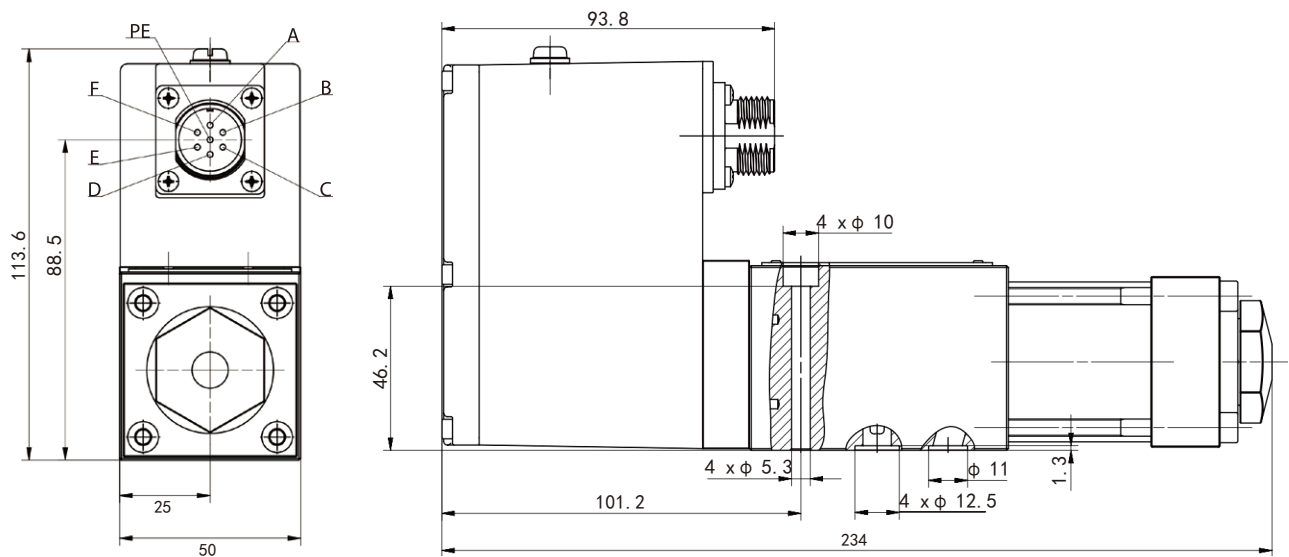


The mounting surface must comply with ISO 4401-03-03-0-05 standards. Note that the mounting length in the Y direction must not be less than 77 mm. To achieve maximum flow, it is recommended that the P, T, A, and B ports be designed with a diameter not less than 7.5 mm (0.3 in). The flatness of the mounting surface should be less than 0.01 mm (0.0004 in) over a distance of 100 mm (3.94 in). Average surface roughness Ra < 0.8 μm.

mm

	P	A	B	T	Y	F1	F2	F3	F4	G
Diameter φ	7.5	7.5	7.5	7.5	3.3	M5	M5	M5	M5	4
X	21.5	12.7	30.2	21.5	40.5	0	40.5	40.5	0	33
Y	25.9	15.5	15.5	5.1	9	0	-0.75	31.75	31	31.75

Dimensional drawing:

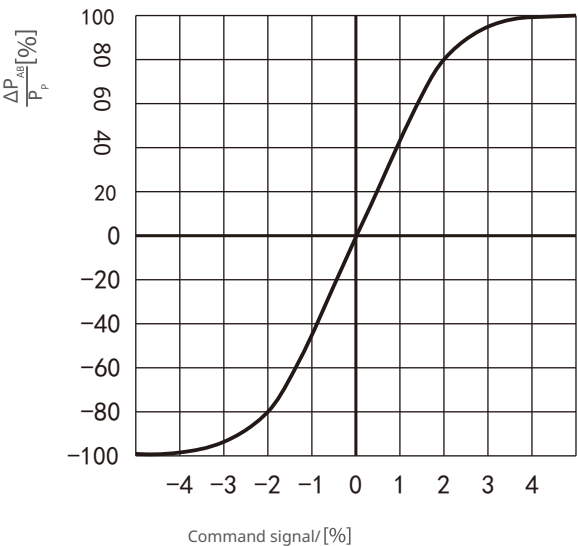


Spare parts and accessories:

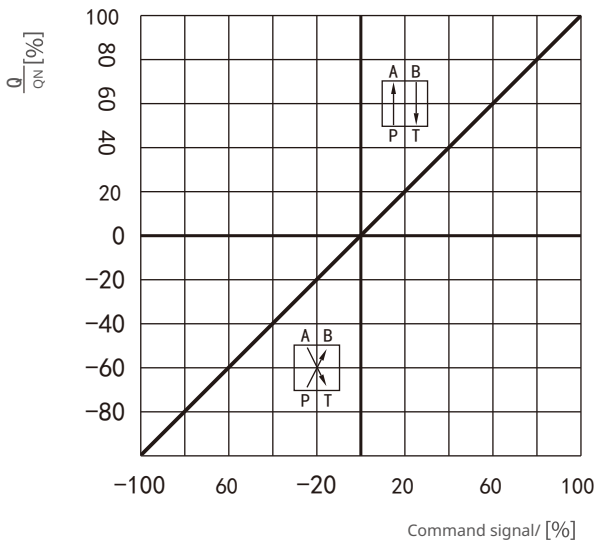
O-ring (included in the standard supply)		Nitrile rubber (fluorocarbon rubber) / NBR (FKM)	
For ports P, T, A, B		4 pieces, outer diameter/wire diameter: 12.8 / 1.78 mm	
For port Y		1 piece, outer diameter/wire diameter: 11 / 1.8 mm	
Matching plug, waterproof rating IP65 (not included in the standard supply) / 6+PE			
According to EN 175201-804, R-type metal material, IP65 protection, crimp contact terminal diameter 0.75 to 1.5 mm ² (0.0012 to 0.0023 in ²), Cone diameter 12.2 mm (0.48 in), cable diameter 9 to 12 mm (0.35 to 0.47 in), sealing element diameter 9 to 13 mm (0.35 to 0.51 in).			
Mounting screws (not included in the standard supply)		Required torque during installation	Required quantity
M5 x 55 DIN EN ISO 4762 - 10.9	A03665 050 055	8.5 Nm(75 inch pounds)	4 pieces

Technical data:

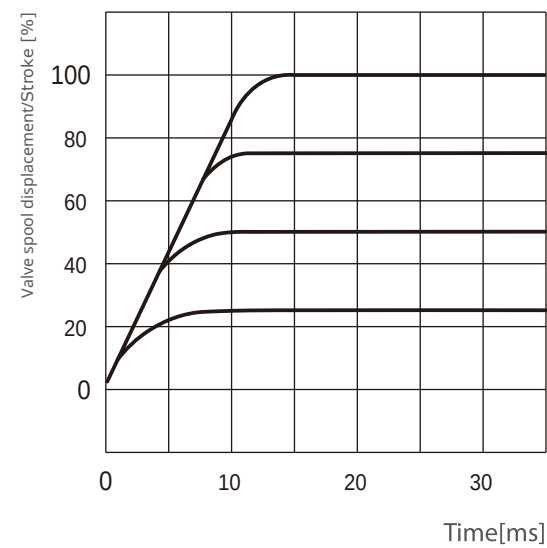
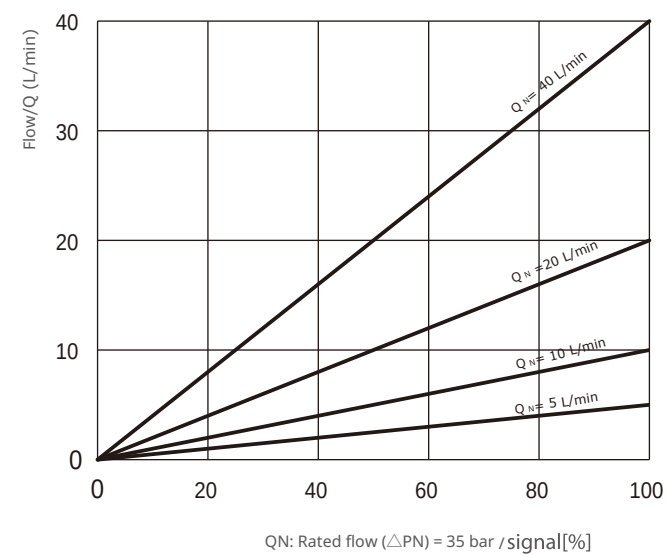
Pressure signal



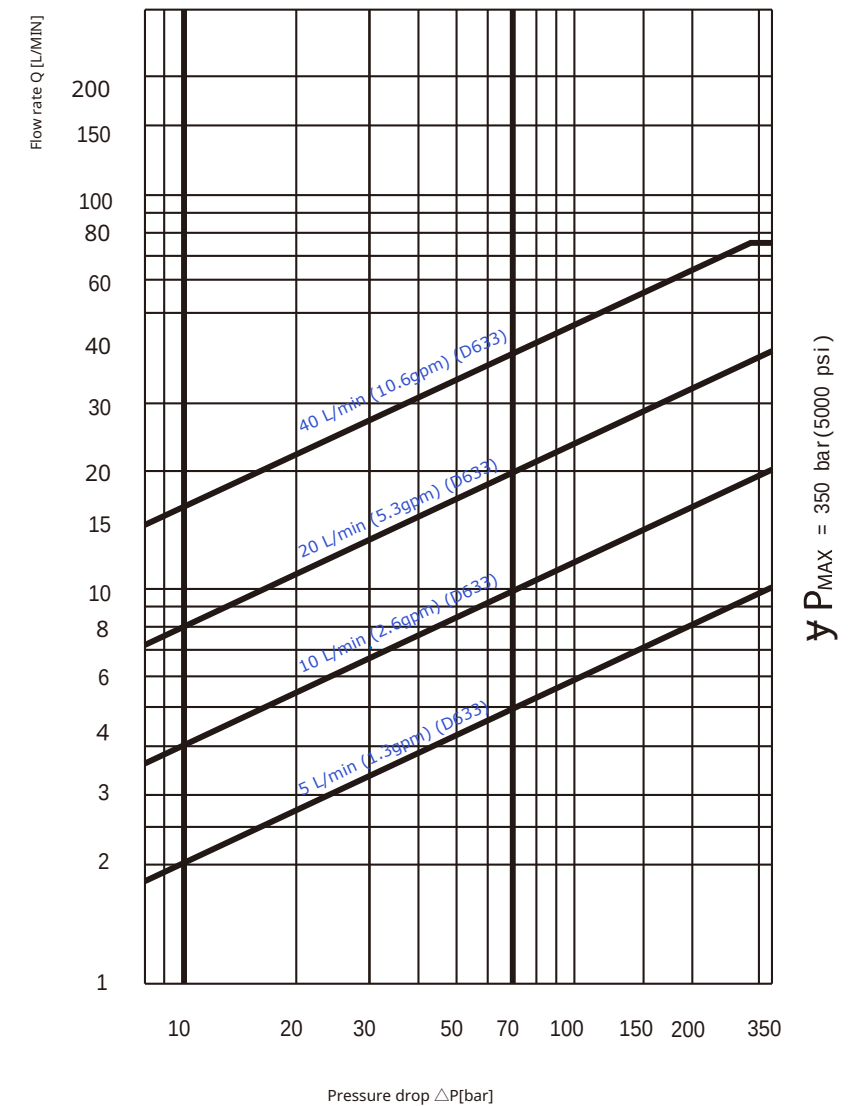
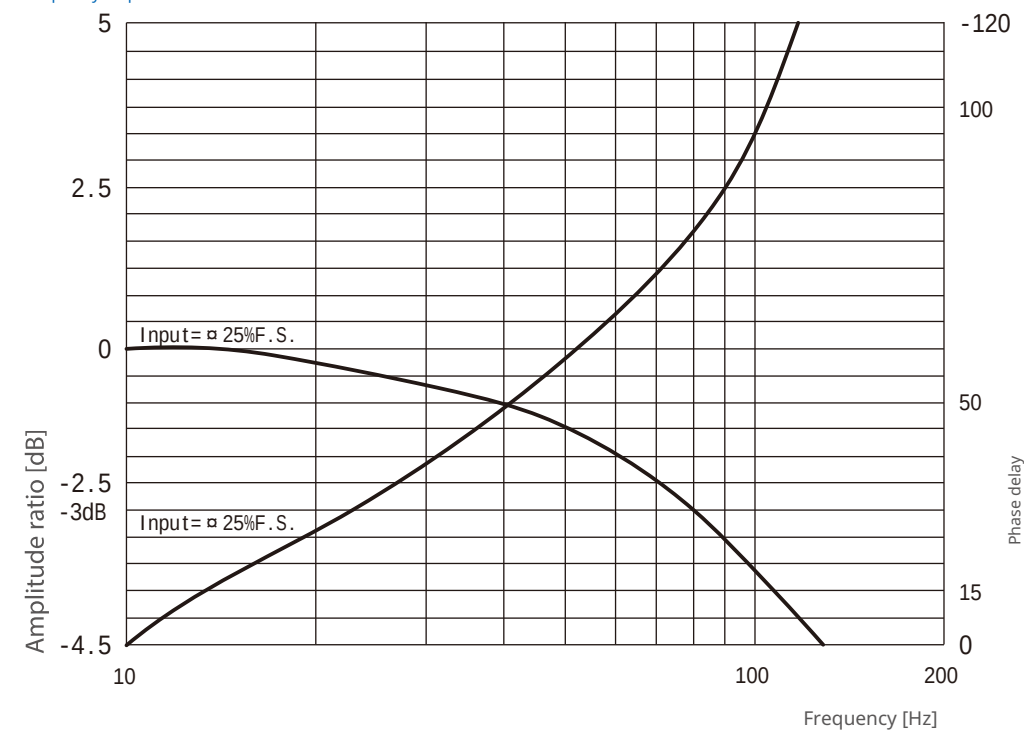
Flow signal



Step response

Flow signal curve, at each valve spool throttling edge $\Delta P_N = 35 \text{ bar}(500\text{psi})$ 

Frequency response



Calculation of valve load flow

The actual load flow of the valve is related to the spool displacement and the pressure drop across the valve orifice.

When a 100% command signal is applied (e.g., +10V DC = fully open 100% at the valve port), under the rated pressure drop ($\Delta P_N = 35 \text{ bar}$ per throttling edge) the load flow is defined as the rated flow Q_N . For other values outside the rated pressure drop, the valve's load flow is proportional to the square root of the pressure drop across the valve's sharp-edged throttling orifice.

$$Q = Q_N \sqrt{\frac{y P}{y P_N}}$$

Q [l/min] = calculated load flow

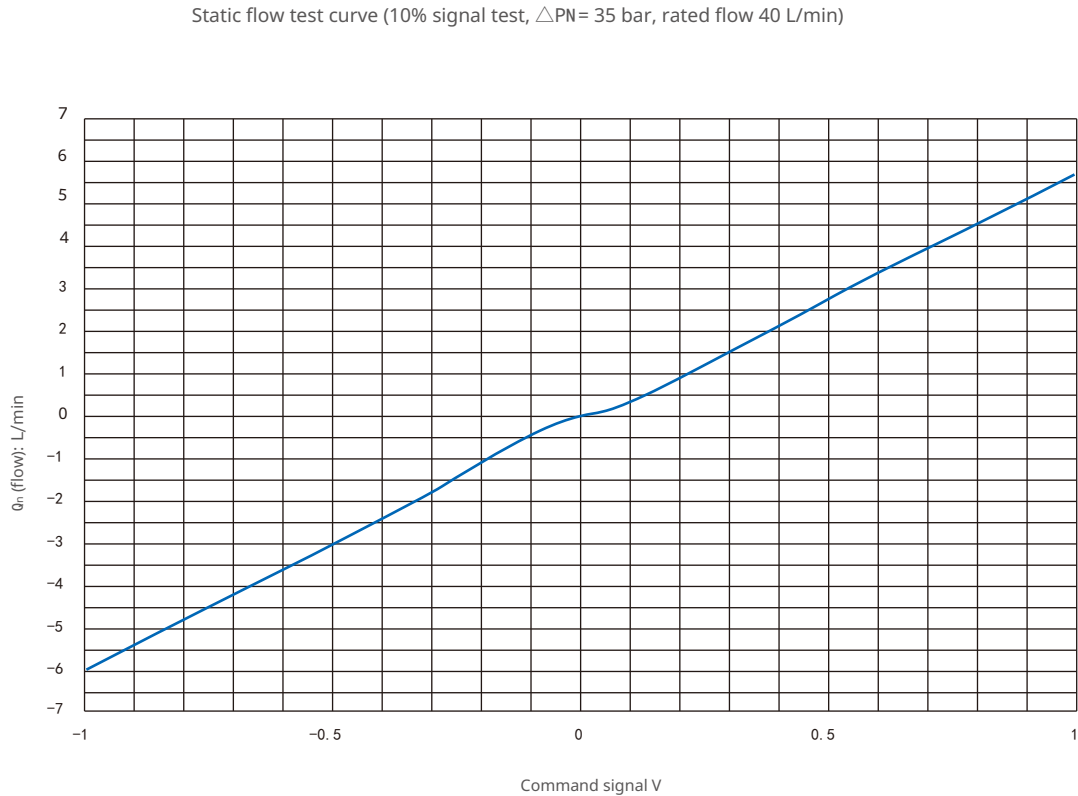
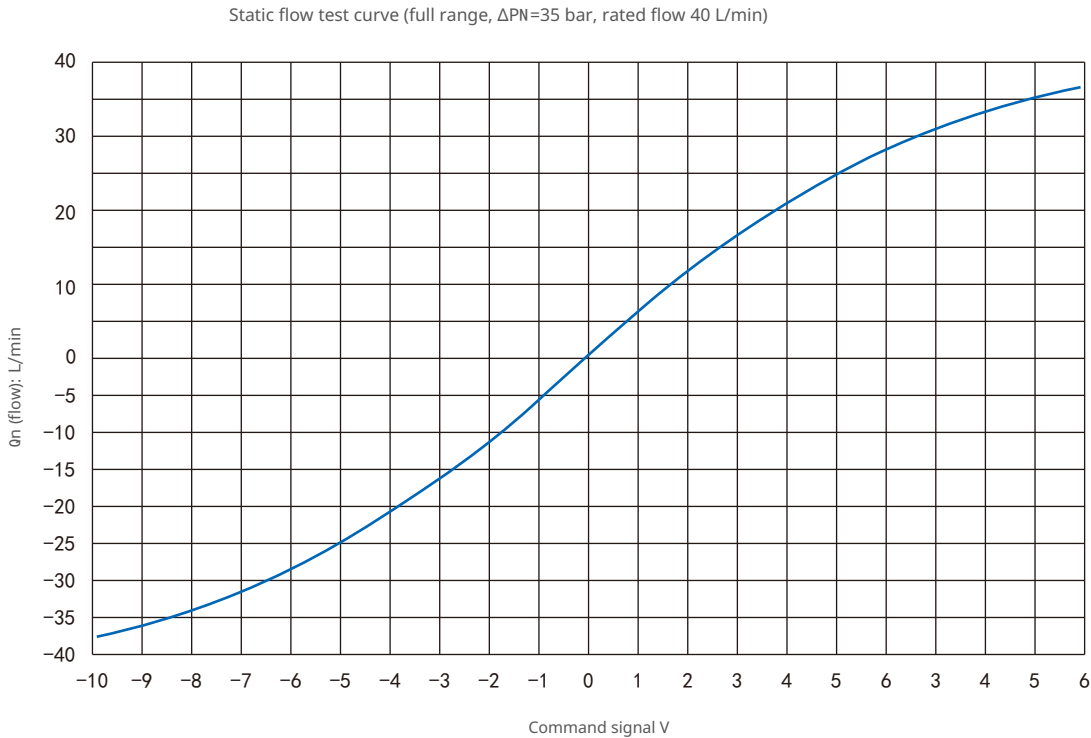
Q_N [l/min] = valve rated flow

$y P$ [l/min] = actual pressure drop of the valve

$y P_N$ [l/min] = rated pressure drop of the valve

When the average flow velocity at the valve's P, A, B, or T port is less than 30 m/s, the valve's load flow Q can be calculated using this method.

Test curve:



Technical data

Valve design	Stage 1, with spool and sleeve
Installation mode	ISO 4401-03-03-0-05 (Installation specification for port y with or without drain ³)
Installation position	No orientation limit
Weight	2555g
Storage temperature range	-40 - +100°C (-40 - +176°F)
Ambient temperature range	-20 - +85°C (-4 - +140°F)
Vibration resistance	30g, 3 axes, 10 Hz to 2 kHz
Shock resistance	50g, 6direction 3ms

Hydraulic data

Maximum working pressure - port P, A, B	350bar (5000psi)
Maximum working pressure - Port T without Y	50bar (725psi)
Maximum working pressure - port T with Y	210bar (3000psi)
Maximum working pressure - Y port	Depressurized to tank
Rated flow at ΔPN = 35 bar (500 psi) across each spool throttling edge	5 L/min 10 L/min 20 L/min 40 L/min
Maximum flow/	75 L/min
Hydraulic oil/	Compliant with DIN 52524 Parts 1 to 3 and ISO 11158 standard hydraulic oil Other fluids available upon request.
Leakage flow (≈ zero overlap) ¹⁾ /	0.15L/min 0.3L/min 0.6L/min 1.2 L/min
Oil temperature range/°N	-20 - +80°C (-4 - +176°F)
Recommended viscosity range at 38°C (100°F)	15 - 100mm ² /s (cSt)
Maximum permissible viscosity range at 38°C (100°F)	5 - 400mm ² /s (cSt)
Cleanliness class recommended according to ISO 4406 for functional safety	18 / 15 / 12
It is recommended that the cleanliness level comply with ISO 4406 to ensure a longer service life	17 / 14 / 11

Note

- 1) Measurement conditions: system pressure 140 bar (2,000 psi), oil viscosity 32 mm² /s, oil temperature 40 °C (104 °F).
- 2) To prevent the return line from draining, maintain a back pressure of 2 bar (29 psi) at the T, T1, and Y ports.

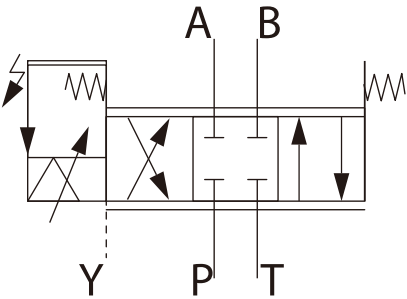
Typical static and and dynamic data¹)

Step response time for 0 to 100% stroke	≤ 12ms
Typical dead zone	0. 05%
Maximum dead zone	< 0. 15%
Typical hysteresis	0. 1%
Maximum hysteresis	< 0. 3%
Zero drift at ΔT = 55K (55°C)	< 1%
Rated flow tolerance	< ±10%

Note

1) Measurements were taken under the following conditions: system pressure of 140 bar (2,000 psi), oil viscosity of 32 mm² /s, and oil temperature of 40°C (104°F).

Four-way valve function



Four-way valve specifications

Spring-centered

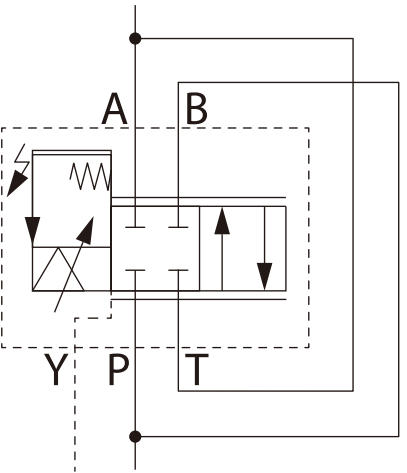
Ports A and B serve as flow-control (throttle valve) ports;

If the pressure at port T P > 50 bar (715 psi), port Y must be used for drain;

When used as a three-way valve, either port A or port B must be blocked;

For axially precise openings, spools with a positive overlap of 1.5 to 3% or 10% are available.

2x2-way valve function parameters



2x2-way valve specifications

(port Y drain is mandatory)

Port A serves as a flow-control (throttle valve) port;

Port Y drain is mandatory;

Connect port P to port B, and port A to port T externally;

Electrical interface diagram:

Electrical data

Degree of protection in accordance with IEC/EN 60529	IP65 protection rating with pre-installed mating plug
Supply voltage¹)	24V _{DC} , min. 19V _{DC} , max. 28V _{DC}
Permissible ripple of the supply voltage²	±2V _{RMS}
Maximum current consumption³	1. 2 A
Power consumption with the motor in the center position	2. 4W (0. 1A@24VDC
Maximum power consumption	28.8 W (1.2 A @ 24V _{DC})
Fuse protection, external, per valve	1. 6A (s low)
Electromagnetic compatibility	Immunity complies with DIN EN 61000-6-2 (assessment criterion A)

Note

1) All connected circuits must be electrically isolated from the mains by “electrical isolation” in accordance with IEC/EN 61558-1 and IEC/EN 61558-2-6. The

voltage must be limited to the Safety Extra-Low Voltage range specified in EN 60204-1. We recommend using SELV/PELV power supply units.

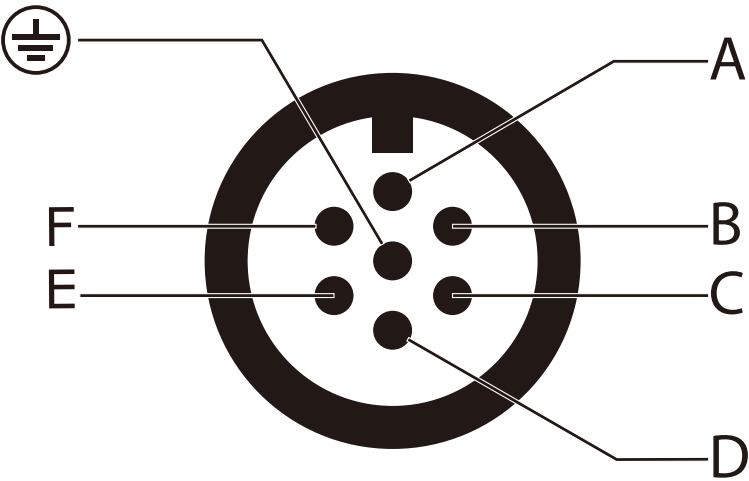
2) Frequency: 50 Hz to 10 kHz.

3) Measurement ambient temperature is 25°C (77°F), power supply voltage is 24 V.

Pin Definition

Pin assignment for valves with a 6+PE-level socket, pin contacts (X1)

Compliant with EN 175201-804, configure with plug (type R or S, metal housing); protective earthing must be installed in advance.



Pin	Pin assignment	Signal type ¹⁾	
		Voltage range	Current range ³⁾
A	Supply voltage	U _{supply} = DC (18 to 28V DC), referenced to ground (reverse-polarity protected ground)	
B	Ground	Power ground Signal ground	
C	Enable signal	U _{EN} > 8,5 to 28 VDC (referenced to GND): valve ready (enabled) U _{EN} < 6.5 VDC (referenced to GND): valve disabled Input resistance is 10 kΩ	
D	Input signal (differential)		
E	Input command ground (differential)	Pin D ² ground)	
F	Spool position feedback	U _{F-B} = 2 to 10 V; U _{F-B} is proportional to the spool position; 6V corresponds to the spool center position; R _L = 500 Ω	I _{out} = 4 to 20 mA, referenced to ground. I _{out} is proportional to the spool position; 12mA corresponds to the spool center position. The output has short-circuit protection. L = 0 to 500 Ω.
↓	Protective earth (PE)	Connect the valve body	

Note

- 1) See the order information for the signal range.
- 2) The potential difference between pin D or E and pin B must be between -15 and +28 V.
- 3) Command signal I_{in} < 3 mA (for example, due to a cable break) indicates failure of the 4 to 20 mA signal.

Customers can customize and activate the valve's response to this fault.

F634 two-stage servo valve



Features

- Direct drive via a permanent-magnet linear force motor with high driving force;
- No pilot oil source required;
- Dynamic performance is not affected by pressure;
- Low hysteresis and high resolution;
- Low power consumption at hydraulic null and when approaching hydraulic null;
- Electrical null adjustment;
- Standardized spool position detection signal, which can be used to obtain system operating status;
- When power is lost or the cable is damaged or in an emergency stop, the spool automatically returns to its spring-centered position without external force;
- Digital circuit drive, anti-interference, higher frequency response, adjustable parameters;

F634 series servo solenoid valve, control solenoid with

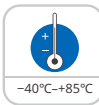
position feedback and built-in electronic circuit (OBE)

Nominal size 10

Maximum operating pressure 315 bar

Maximum flow 100 L/min (Δp 70 bar)

Product features:



Temperature Range



EMC



Vibration/Shock resistance



Magnetic field protection



IP protection rating



Short-circuit protection



Reverse polarity protection



Leakage flow



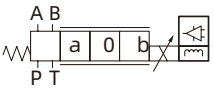
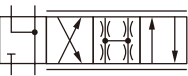
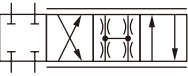
Fast response time



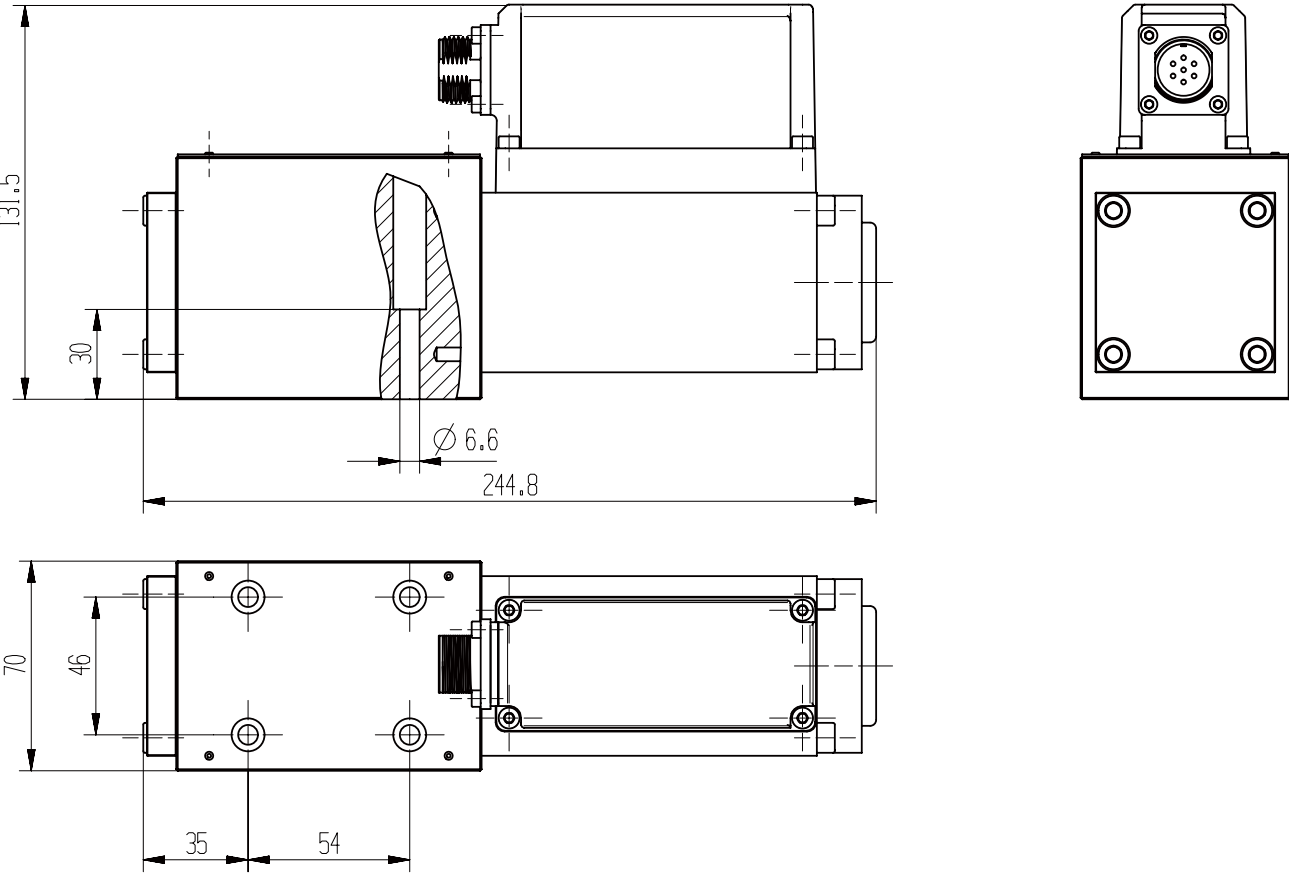
Import substitution

Model selection code																			
F634		-	X	-	X	-	X	-	X	-	X	-	X	-	X	-	X	-	X
			a		a		a		a		b		c		d		e		
a Function symbols																			
4-position, 4-way																			
c QN/Rated flow ΔP per throttling edge = 35 bar (500 psi)																			
1=50 L/min 2=100 L/min X = For other requirements, please consult																			
d Input signal																			
1 = +/- 10V 2=4-20mA 3 = For other requirements, please consult																			
b Flow characteristics																			
1 = Linear 2 = For other requirements, please consult																			
e Sealing material																			
1 = Nitrile Rubber 2 = Fluororubber 3 = For other requirements, please consult																			

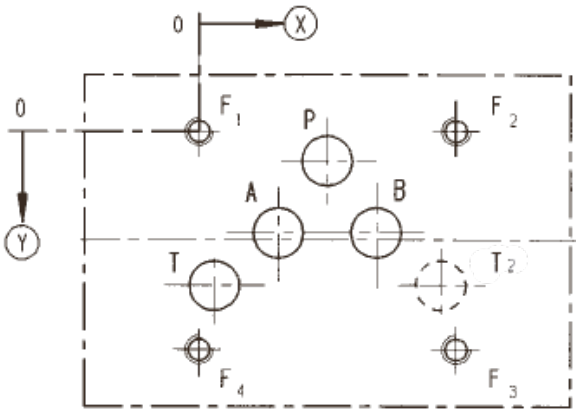
Function symbols:

	Linear	P: inflection point 40%
	Y	
	O	
	Y,O	
	Y,O	

F634
Component dimensions (unit: mm)



Mounting surface:



△ Notes:
Do not connect port P and port T incorrectly; if port T is subjected to pressure above 10 MPa, the product may be seriously damaged!

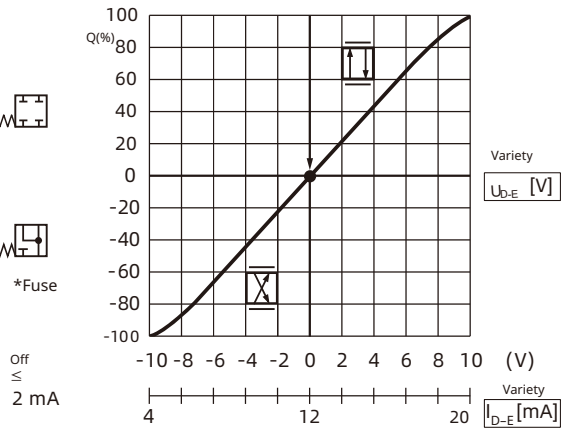
Mounting interface complies with ISO 4401									
	P	A	T	T2	B	F1	F2	F3	F4
Diameter φ mm	10.5	10.5	10.5	10.5	10.5	M6	M6	M6	M6
X	27	16.7	3.2	50.8	37.3	0	54	54	0
Y	6.3	21.4	32.5	32.5	21.4	0	0	46	46

Technical data:

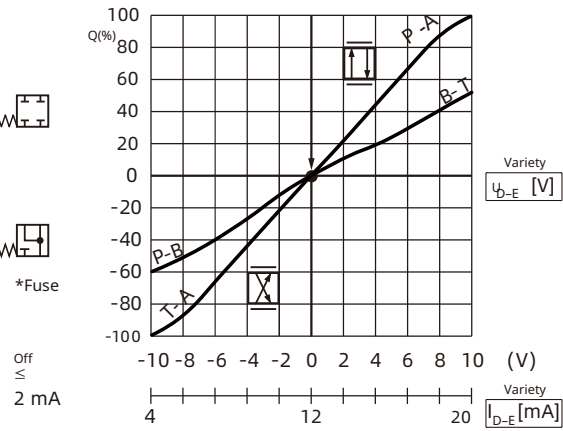
Characteristic curve (measured with HLP 46 at an oil temperature of 40°C ±5°C)

Flow curve $Q = f(U_D - \epsilon)$
 $Q = f(I_D - \epsilon)$

L: Linear 1:1

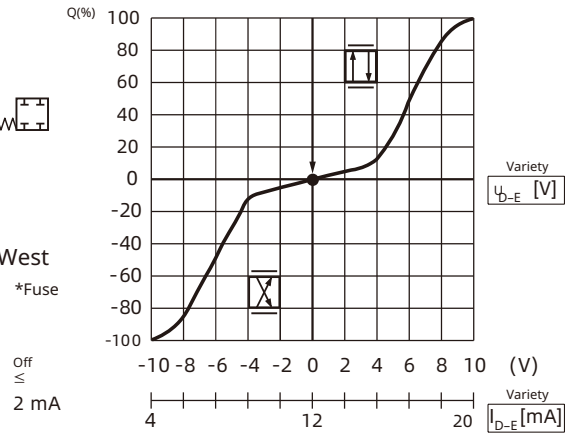


L: Linear 2:1



Technical data:

P: (turning point 40%) 1:1



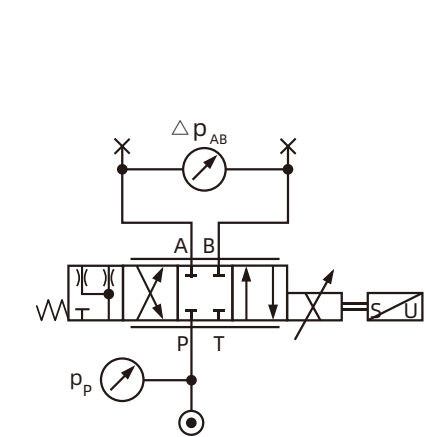
* Fuse: U B ≤ 18 V DC (Variant U D-E) * Fuse: U B ≤ 18 V DC / I D-E ≤ 2 mA (Variant I D-E 4...20mA)

	Safe position		
	Leakage at	100 bar	P - A 50 cm³/min P - B 70 cm³/min
	Flow at	Δp = 35 bar q _n 50/100 L/min	A - T 110...100 L/min B - T 10/25 L/min
	Leakage at	100 bar	P - A 50 cm³/min P - B 70 cm³/min A - T 70 cm³/min B - T 50 cm³/min
	Insurance	p = 0 bar → 12 ms	Internal enable disabled U _B ≤ 18 V D C (I _{D-E} ≤ 2 m A)
		p = 100 bar → 16 ms	

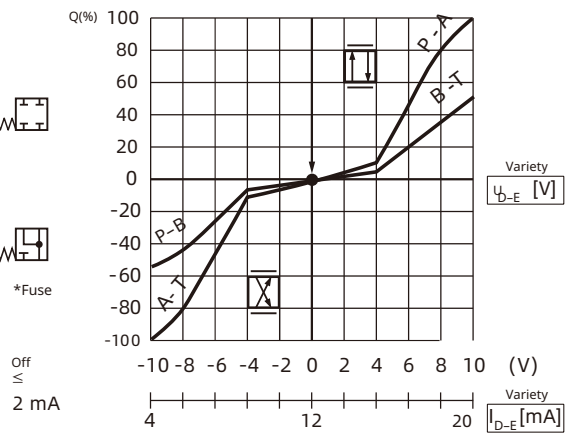
F634

Characteristic curve (measured with HLP 46 at an oil temperature of 40°C ±5°C)

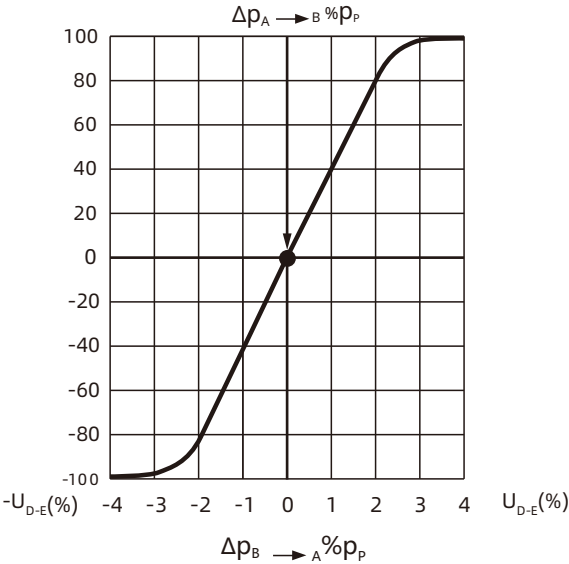
Pressure gain



P: (turning point 40%) 2:1

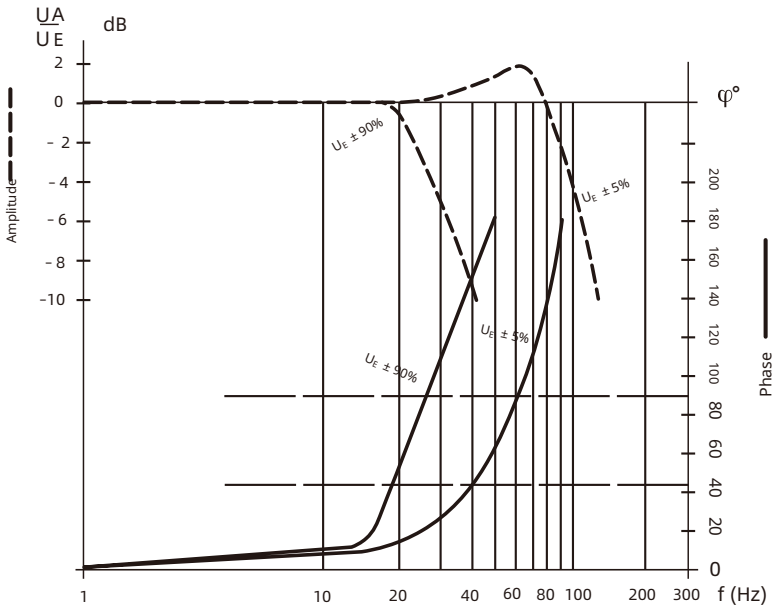
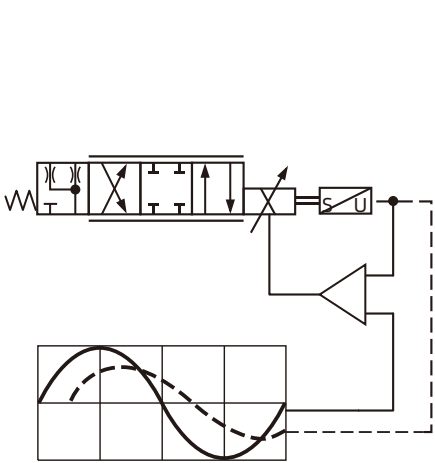


Calibration ±1%



Technical data:

Bode plot



F634

Connection

Technical notes regarding cables

- Type: - Multicore cable
- High-quality stranded wire, according to VDE 0295,6 class
- Protective conductor, green/yellow
- Copper braid shielding

Wire number: - Determined by the valve model, plug type, and signal arrangement

Cable diameter Ø: - Cable diameter 8-12.5 mm

Note

Nominal supply voltage 24V DC nom.

If the voltage drops below 18V DC, an internal rapid shutdown is triggered, similar to "enable off."

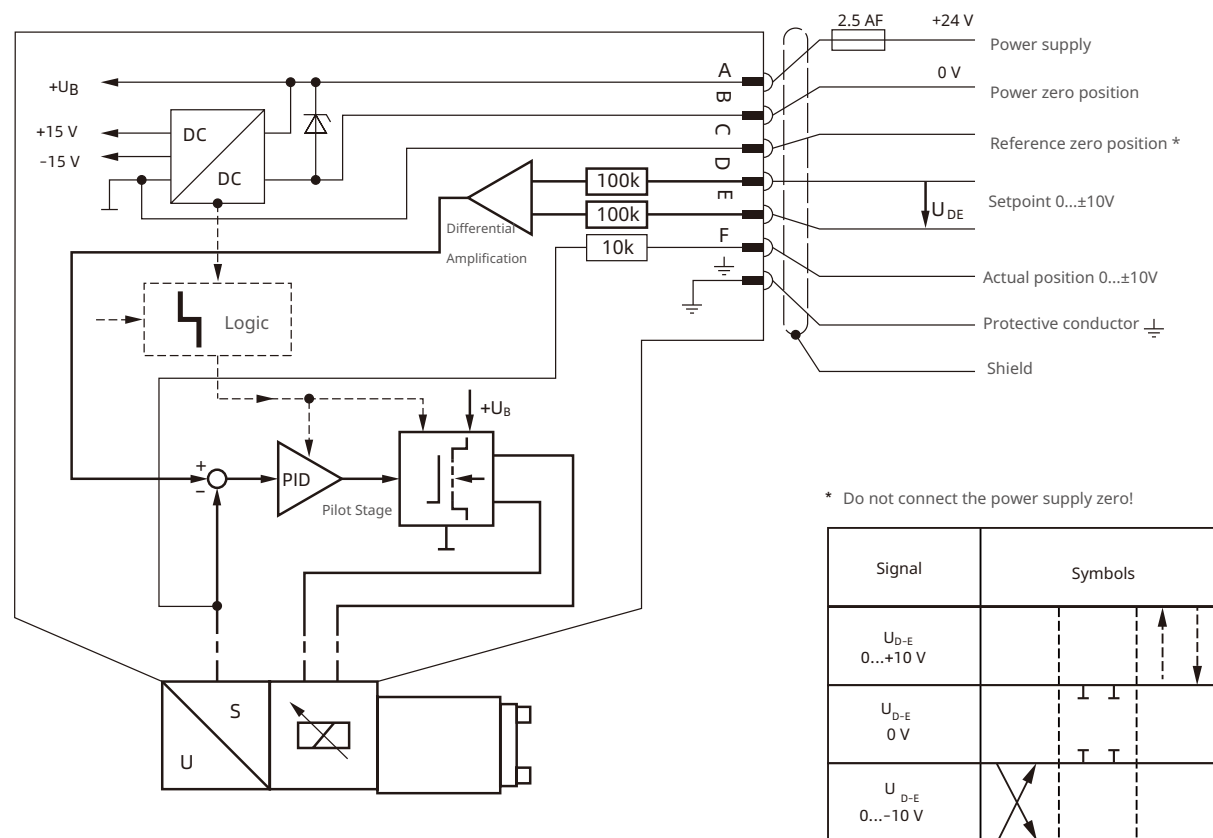
Furthermore, electrical signals emitted by the trigger electronics (e.g.RMS) must not be used to shut down safety-related machine functions!(see European standard "Fluid power — Hydraulic systems and components — Technical requirements for safety," EN982)

Technical data:

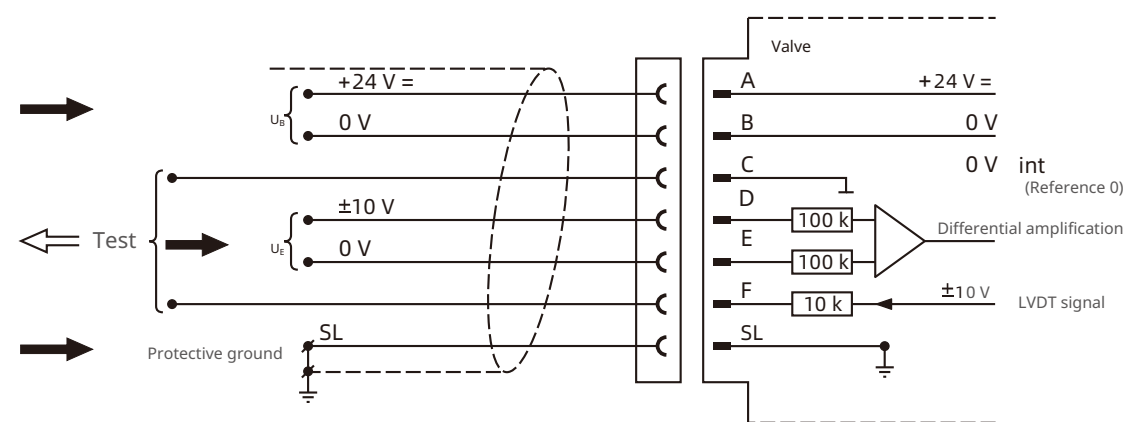
F634

Built-in trigger electronic circuitry

Block diagram/Pin assignment

Variety A1: $U_{D-E} \pm 10\text{ V}$ 

Pin assignment 6P+PE

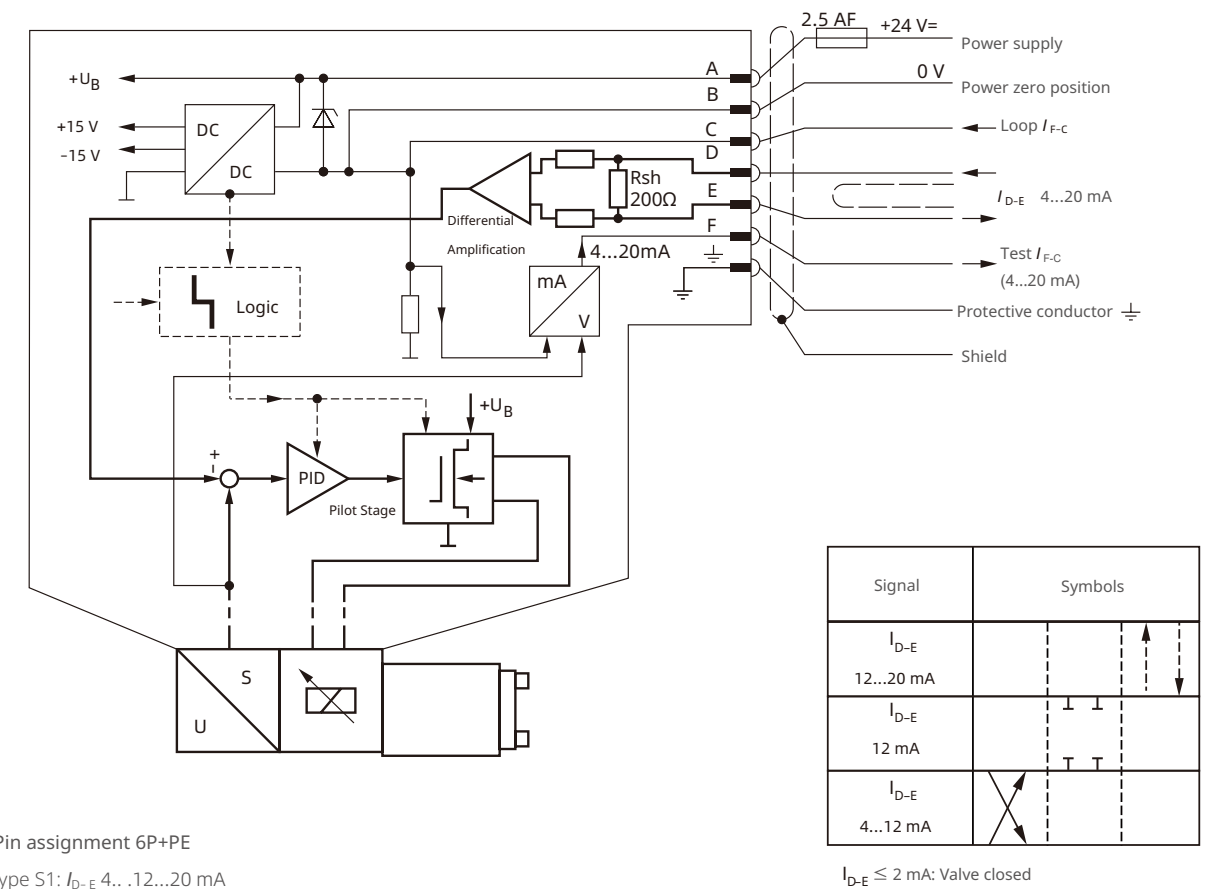
Type A1: $U_{D-E} \pm 10\text{ V}$ (R_i = 100 kΩ)

Technical data:

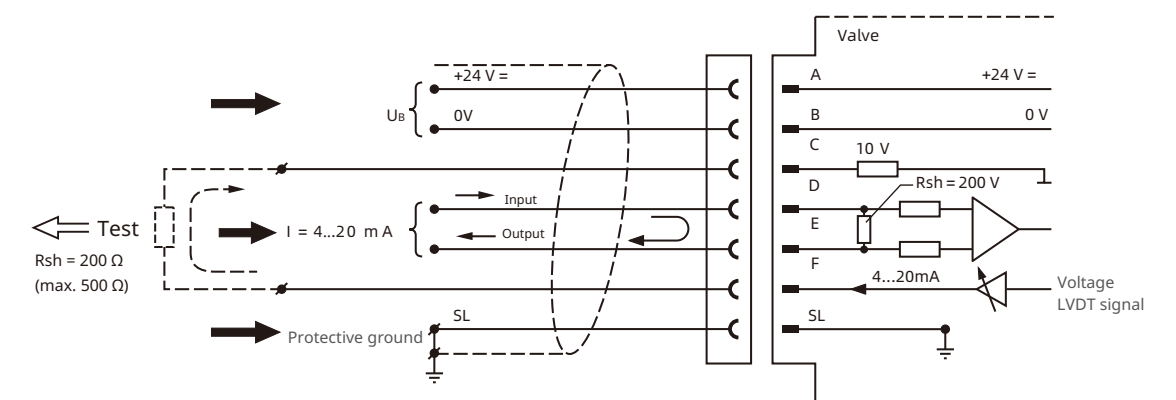
F634

Built-in trigger electronics

Block diagram/pin assignment

Variant S1: I_{D-E} 4...12...20 mA

Pin assignment 6P+PE

Type S1: I_{D-E} 4...12...20 mA(R_{sh} = 200 Ω)

Technical data:

Structure	Spool type, direct-acting, with steel valve sleeve
Drive	Proportional solenoid with position control, built-in electronics
Mounting type	Baseplate, mounting interface nominal size 6 (ISO 4401 and CETOP-RP 121 H)
Installation position	Optional
Ambient temperature range	-20 ... +50°
Mass	7.1 Kg
Vibration resistance, test conditions	Max 25 g, 3-dimensional vibration (24 h)

Hydraulic parameters (measured with HLP 46 at an oil temperature of 40°C ±5°C)

Pressure oil	Hydraulic oil according to DIN 51 524 ...535; please consult in advance for other oils			
Viscosity range, recommended value	20...100 mm 2/s 10...800 mm 2/s			
Maximum permissible value Pressure oil temperature range	-20...+70°C			
Cleanliness class, according to ISO code	Maximum permissible contamination level of the pressure oil according to ISO 4406(C) class 18/16/13 ¹⁾			
Flow direction	See functional symbol			
Nominal flow rate [l/min] at Δp = 35 bar per throttling edge*	50 (1:1)	50 (2:1)	100 (1:1)	100 (2:1)
Maximum operating pressure	Oil ports P, A, B: 315 bar			
Maximum pressure	Port T: 250 bar			
Operating limit at Δp [bar]		315	315	160
Valve pressure drop		250	250	100
q _{vnom} -> q _{N Valve}		<1200	<1200	<1500
Leakage [cm³/min] at 100 bar		<600	<500	<600

Static/Dynamic	
Hysteresis	≤ 0.2%
Manufacturing tolerance, for q _{max} .	<10%
Response time, for signal change 0...100%	<10 ms
Temperature drift	Zero-point shift <1%, at ΔT = 40°C
Zero-point adjustment Factory setting ±1%	Factory setting ±1%

1) In hydraulic systems, the cleanliness level required by the components must be achieved. Effective filtration prevents problems and also extends the service life of the components. Select filters, see catalogs RE 50 070, RC 50 076, and RC 50 081.

* Flow rate at differential pressure Δp:

$$Q_x = Q_{nom} \cdot \sqrt{\frac{\Delta p_x}{35}}$$

Technical data:

Electrical, trigger electronics integrated in the valve

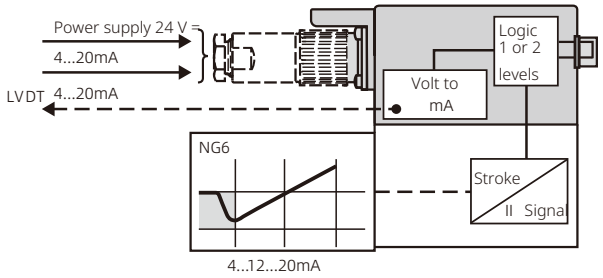
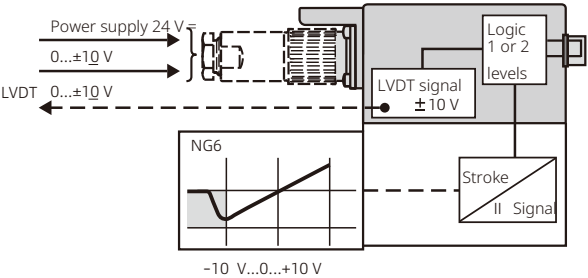
Duty cycle	100% ED
Protection rating	IP65 according to DIN 40 050 and IEC 14 434/5
Connection	Connector plug 6P+PE, DIN 43 563
Power supply Terminal: A B:0V	24 V DC _{nom.} min. 19 V DC / _{max.} 36 V DC Ripple _{max.} 2 V DC
Power consumption	Solenoid 45 mm - 40 VA max.
External fuse	2.5 A _F
Input, "standard" variant Terminal D: I _{D-E} E: I _{D-E}	Differential amplifier, R _i > 100 kΩ 0...±10V 0V
Input, "mA signal" variety Terminal D: I _{D-E} E: I _{D-E}	Load, R _{st} = 200Ω 4...(12) ... 20 mA Current loop I _{b-E} feedback
Maximum differential input voltage at 0V	D → B E → B } max. 18 V DC
Detection signal, "standard" variety Terminal F: U _{Test} C:	LVDT -10 ... +10 V Reference 0V
Detection signal, "mA signal" types Terminal F: I _{F-C} C: I _{F-C}	LVDT signal 4...20 mA with external load 200...500Ω max. 4...20 mA output Current loop I _{F-C} feedback
Protective conductor and shielding	See pin assignment (installation compliant with CE)
Recommended cable	See pin assignment Up to 20 m 7×0.75 mm² Up to 40 m 7×1 mm²
Calibration	Calibrated at the factory, see the valve performance curve

Type A1:

Standard

Type S1:

Standard



F761 Rotary Direct-Drive Servo Valve



- Features**
- Independent intellectual property rights
 - Compact, miniaturized structure;
 - High pressure resistance,
 - high-frequency response; low internal leakage, contamination resistance;

The F761 Rotary Direct Drive Valve (RDDV) uses a rotary motor to drive the spool to produce linear displacement, thereby controlling the opening and closing of the valve ports and ultimately achieving precise flow out put. Utilizing metal 3D printing technology and process design for the valve's core hydraulic structure gives the F761 valve a compact size, lighter weight compared to similar products, ultra-high contamination resistance and dynamic performance, while continuing the direct-drive valve's excellent low-pressure performance and high reliability.

Product features:

Temperature Range

EMC

Vibration/Shock resistance

Magnetic field protection

IP protection rating

Short-circuit protection

Reverse polarity protection

Leakage flow

Fast response time

Import substitution

Model selection code F761 -

Xa

 -

Xb

 -

Xc

 -

Xd

 -

Xe

 -

Xf

 -

Xg

a	Rated flow (L/min)					
	1=05 L/min	2=10 L/min	3=20 L/min	4=30 L/min	5=40 L/min	6=55 L/min
b	Spool neutral position function					g Omitted = Standard version
	1 = zero overlap		2 = 3% coverage		EX = Explosion-proof version	
c	Input signal					
	1= +/- 10v		2= +/- 10mA			
d	Electrical interface					
	1 = 7-pin		2 = 4-pin			
e	Sealing material		1 = EPDM (Ethylene Propylene Diene Monomer)		2 = Fluororubber (FKM)	
f	Null position function					
1 = Indeterminate, fail-safe function without fault						
2 = Zero position on power-off						
3 = P→A 15% 4 = P→B 15%						

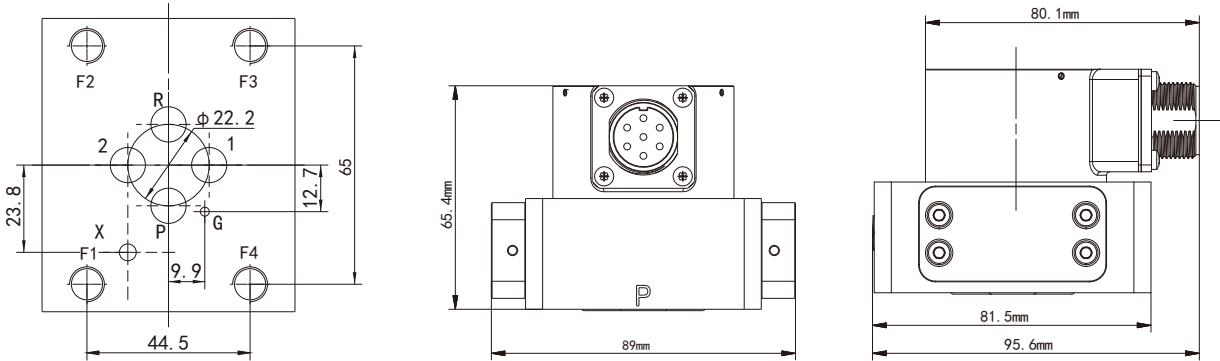
Example: F761-1-2-1-2-2-1

F761-05 L/min -3% overlap - +/- 10v - 4-pin Fluororubber - fail-safe function not available

* Customizable upon user request

Mechanical mounting interface diagram:

- ※ (Installation surface diagram matched with the valve)
- Notes:**
Do not connect port P and port T incorrectly; if port T is subjected to pressure above 10 MPa, the product may be seriously damaged!



Installation Requirements Reference Standards

Mounting Surface

Valve Mounting Surface Requirements

- Flatness of the surface: 0.01 mm/inch (0.005 mm) or better
- Average surface roughnessR_a , better than 0.8 μm.

Ports

According to the maximum flow rate, the oil ports must be designed as follows:

- P, T, A, B port diameter is 8.2 mm.

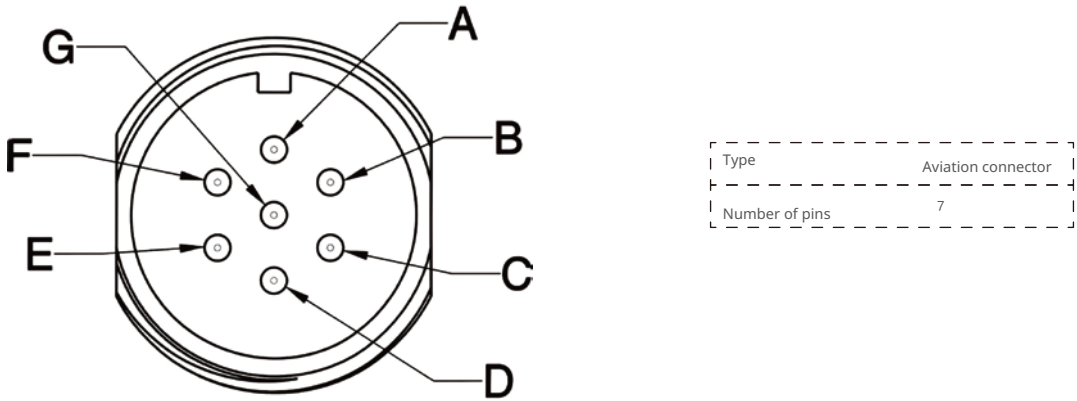
Recommended Mounting Seals

Standard O-ring sealing ring, rubber hardness 90 +/- 5, compatible with hydraulic oil.

P,A,B,T ports use MIL-R-83248 size -013; X port uses MIL-R-83248 size -012.

The mounting interface complies with ISO 10372-04-04-0-92										
	P	1	R	2	X	G	F1	F2	F3	F4
Diameter φ	φ 9. 6 Max	φ 9. 6 Max	φ 9. 6 Max	φ 9. 6 Max	φ 5 Max	φ 2. 8 Min	M8	M8	M8	M8
Surface finish better than 0.8 μm and installation surface roughness < 0.03 TIP										

Electrical interface diagram:



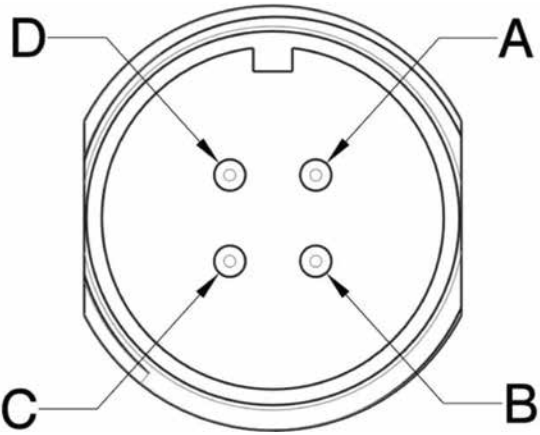
7-pin interface diagram

Pin	Function	Description
A	Power supply +	+ 24V
B	Power ground	0V
C	Enable signal	$U_{EN} > 8.5$ to $28V_{DC}$ (Referenced to GND): valve ready $U_{EN} < 6.5V_{DC}$ (Referenced to GND): valve disabled Input resistance is 10 k Ω
D	Signal +	Differential input signal, +
E	Signal -	Differential input signal, -
F	Spool position feedback	$U_{FB} \approx 2$ to 10 V; U_{FB} proportional to spool position; 6V corresponding to the spool centerposition; $R_L = 500 \Omega$. $I_{out} \approx 4$ to 20 mA I_{out} proportional to spool position; 12 mA corresponding to the spool center position; output has short-circuit protection $R_L = 0$ to 500Ω .
G	Protective earth (PE)	Connect the valve body

1): When the enable function is selected, the function of pin C is enable input.
This will override the original pin function.

Note: When the input signal is a current input, the given signal must remain floating
and must not exceed 5% of the maximum value; otherwise, it will cause damage to the valve.

Type	Aviation connector
Number of pins	4



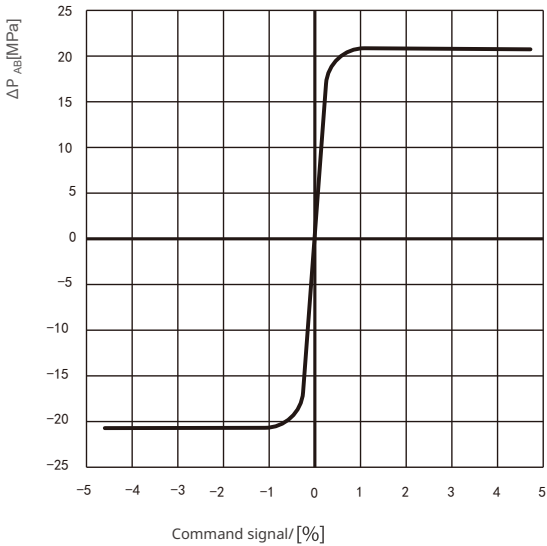
4-pin pinout diagram

Pin	Function	Description
A	Power supply +	+ 24V
B	Signal +	Differential input signal, +
C	Signal -	Differential input signal, -
D	Power ground	0V

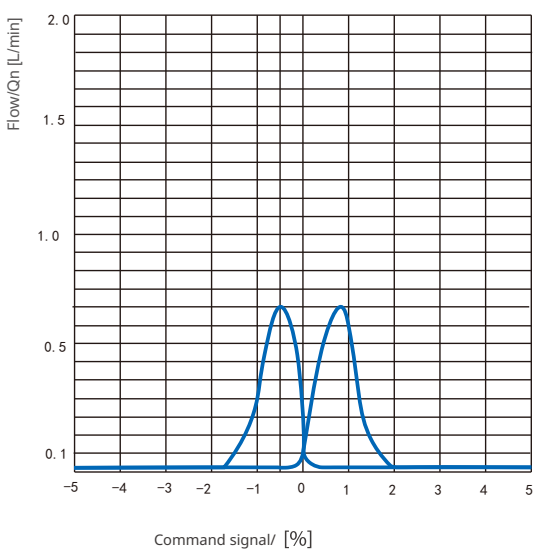
Electrical interface
All connectors comply with EN175201-804/MIL5015 or equivalent sizes, shell size 14.

Technical data:

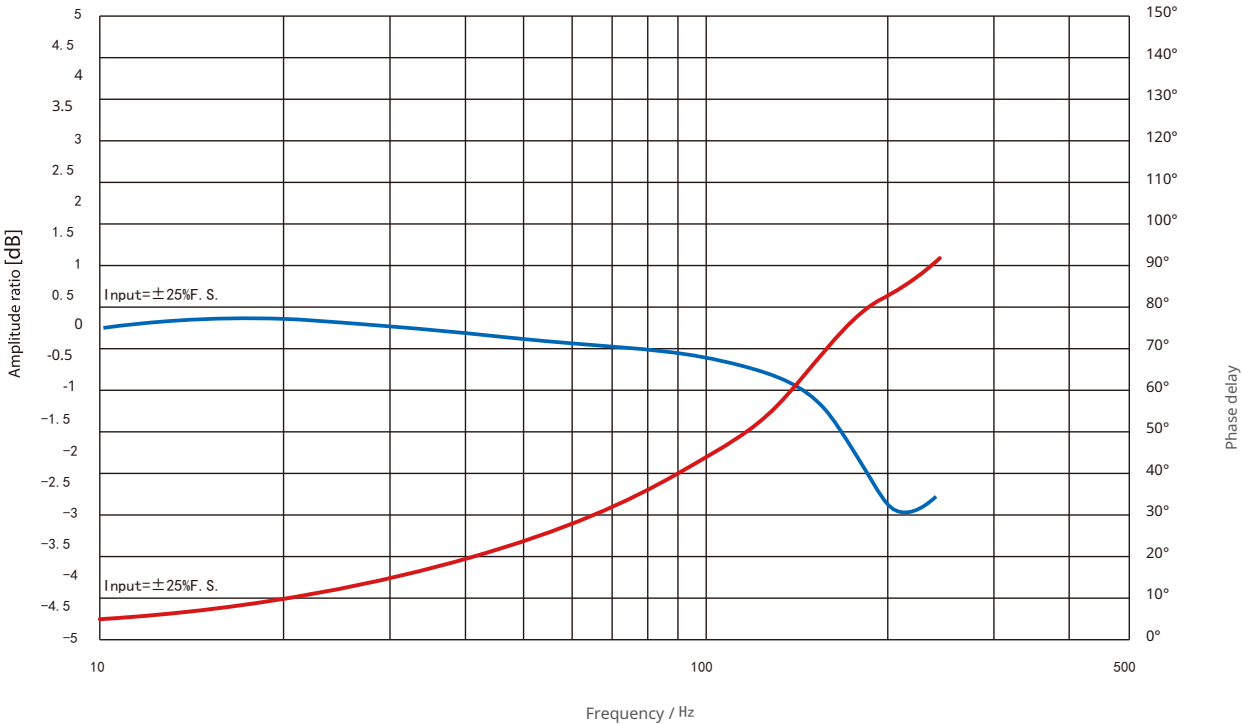
Pressure signal



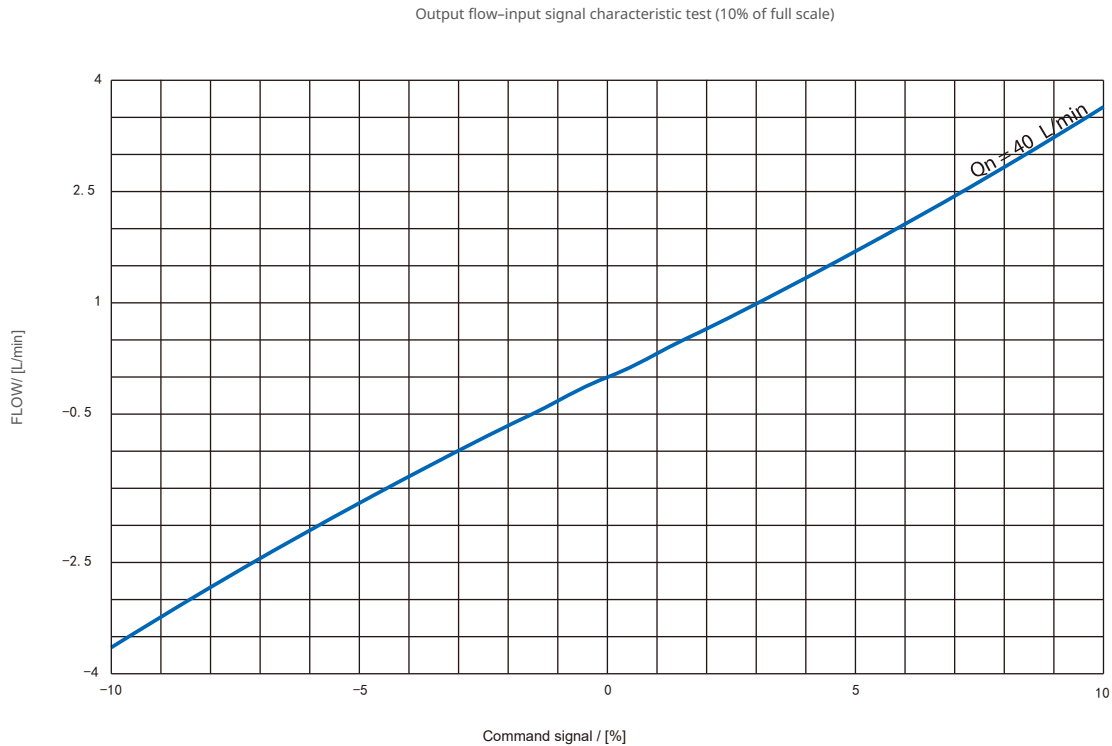
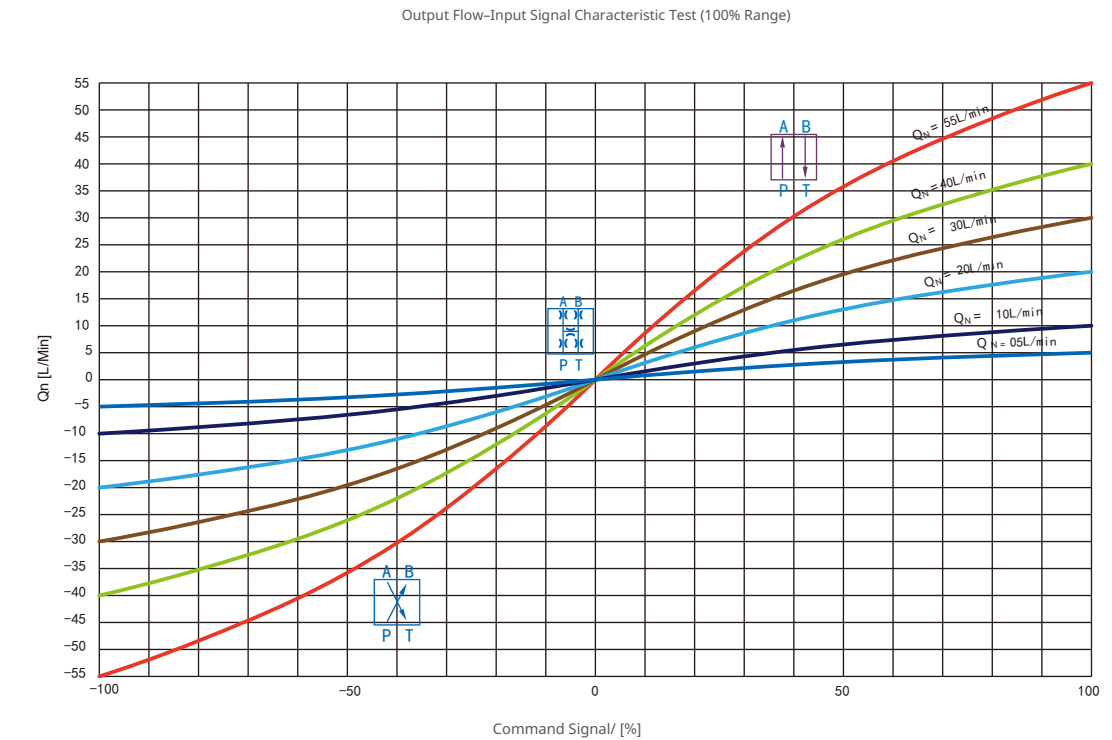
Leakage flow



Dynamic characteristics test



Technical data:



Conventional		
Form	Rotary direct-drive servo valve	
Drive	Rotary motor	
Mounting interface	ISO 10372-04-04-0-92	
Contamination resistance	NAS Class 8	
Vibration resistance	(g)	Three-axis 30
Ambient temperature	(C)	-40 ... +85 (higher, please contact customer service)
Dimensions	(mm)	89 x 95.6 x 65.4
Weight	(g)	820
Hydraulic		
Maximum working pressure	(Bar)	P, A, B < 350; T < 250;
Hydraulic oil	DIN51524-535	
Fluid temperature	(C)	-20 ... +80
Viscosity	(cSt)	5 ... 500
Rated flow $Q_N = 35$ bar on one side	(L/min)	5 / 10 / 20 / 30 / 40 / 55
Internal leakage at 210 bar	(L/min)	<1.5%
Static/ Dynamic		
Step response (100% signal)	(ms)	<3.5
Frequency response ($\pm 25\%$ signal)	(Hz)	>200
Hysteresis	(%)	<1
Resolution	(%)	<0.3
Zero drift	(%)	<0.2
Electrical characteristics		
Supply voltage	(V)	20-28 (typical value 24)
Maximum supply current	(A)	4.5 (stall current)
Input signal	$\pm 10V$ / $\pm 10mA$ / $\pm 20mA$ / 4...20mA (For other requirements, please inquire)	
Electromagnetic compatibility	EN61000-6-2, EN55011:1998+A1	
Plug connector	EN175201-804	

F200 Rotary Direct-Drive Servo Valve



- Features
- Independent intellectual property rights
 - Compact, miniaturized structure;
 - High-pressure resistance, high-frequency response;
 - Low internal leakage, contamination resistance;

The F200 Rotary Direct-Drive Servo Valve (RDDV) uses a rotary motor to drive the spool to produce linear displacement, thereby controlling the opening and closing of the orifice and ultimately achieving precise flow output to drive the load to move. By adopting metal 3D printing technology to design the core hydraulic structure, the F200 valve features a more compact size, lighter weight compared to similar products, ultra-high contamination resistance and dynamic performance, while continuing the direct-drive valve's excellent low-pressure performance and high reliability.

Product features:

Temperature Range

EMC

Vibration/Shock resistance

Magnetic field protection

IP protection rating

Short-circuit protection

Reverse polarity protection

Leakage flow

Fast response time

Import substitution

Model selection code F200 -

a

 -

b

 -

c

 -

d

 -

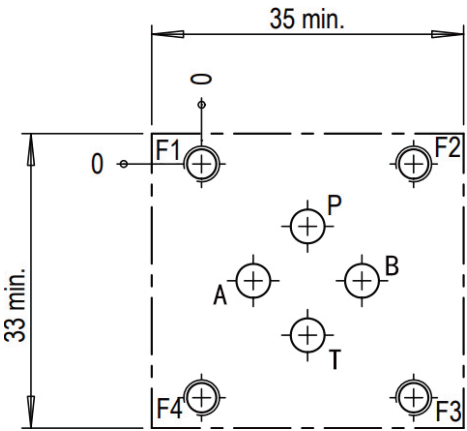
e

a	Rated flow (L/min)			
	1 = 05 L/min	2= 07 L/min	3= 10 L/min	4= 15 L/min
b	Spool neutral position function			
	1 = zero overlap	2 = 3% coverage		
c	Input signal			
	1= +/- 10v	2= +/- 20mA		
	3= 4...20mA			
d	Sealing material			
	1 = Nitrile rubber (NBR)	2 = Fluororubber (FKM)		
e	Spool position when power is off			
	1: Zero position			

Example: F200-1-2-3-1-1
F200-05 L/min-3% overlap-4...20mA-NBR (nitrile rubber)-zero position

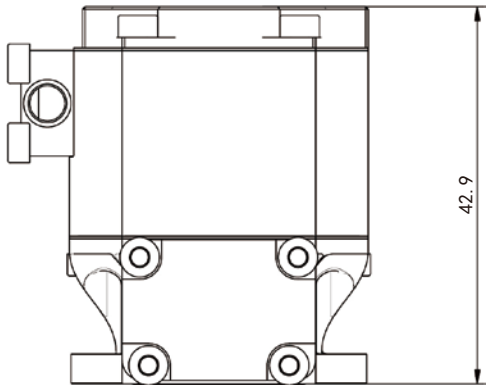
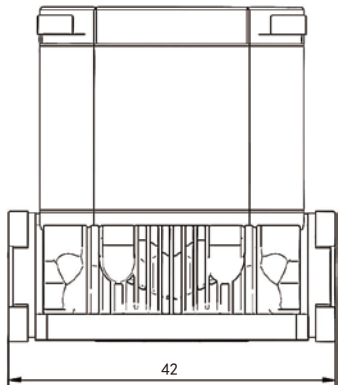
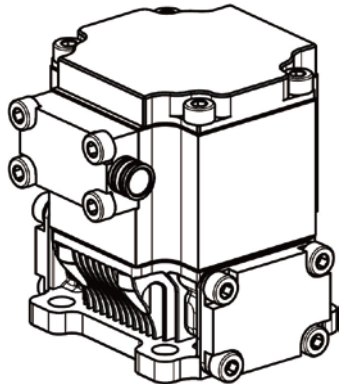
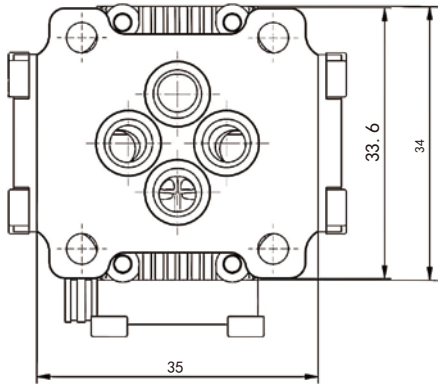
* Customizable upon user request

Mechanical mounting interface diagram:



Mounting interface complies with ISO 10372-01-01-0-92 (without locating pin)									
		P	A	B	T	F1	F2	F3	F4
Diameter ϕ	mm	$\phi 3.8$	$\phi 3.8$	$\phi 3.8$	$\phi 3.8$	M4	M4	M4	M4
X	mm	11.9	5.8	18	11.9	0	23.8	23.8	0
Y	mm	7	13.1	13.1	19.2	0	0	26.2	26.2
Surface flatness within 0.01/100; surface roughness better than 0.8 μm									

Dimensional drawing:



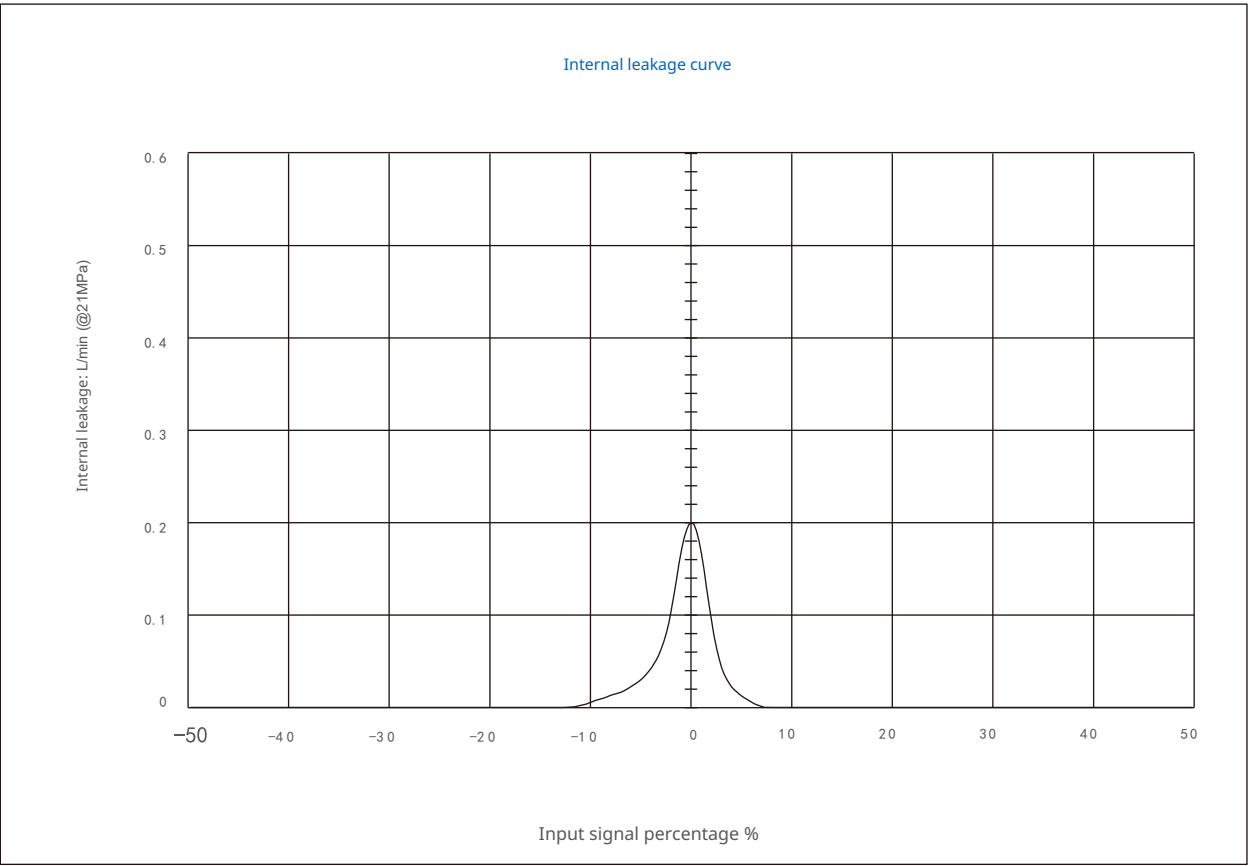
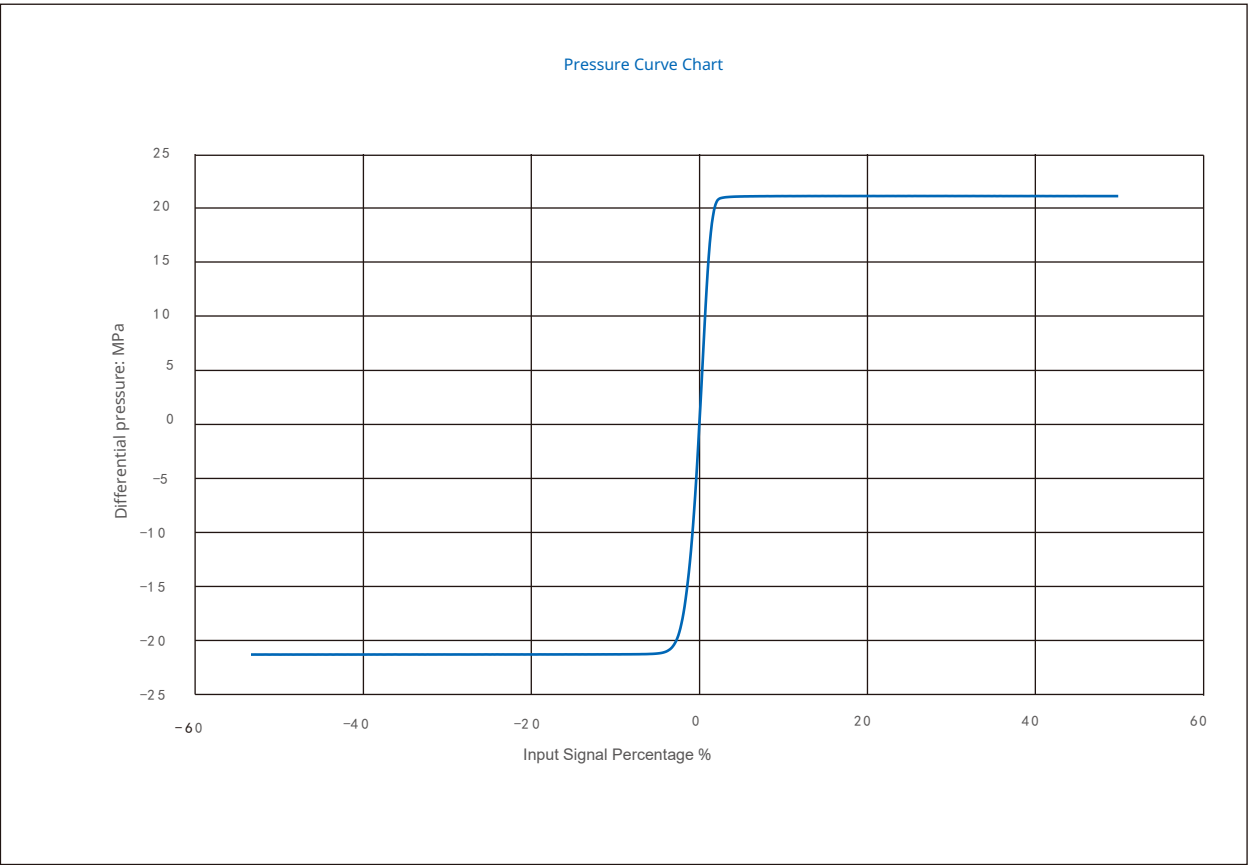
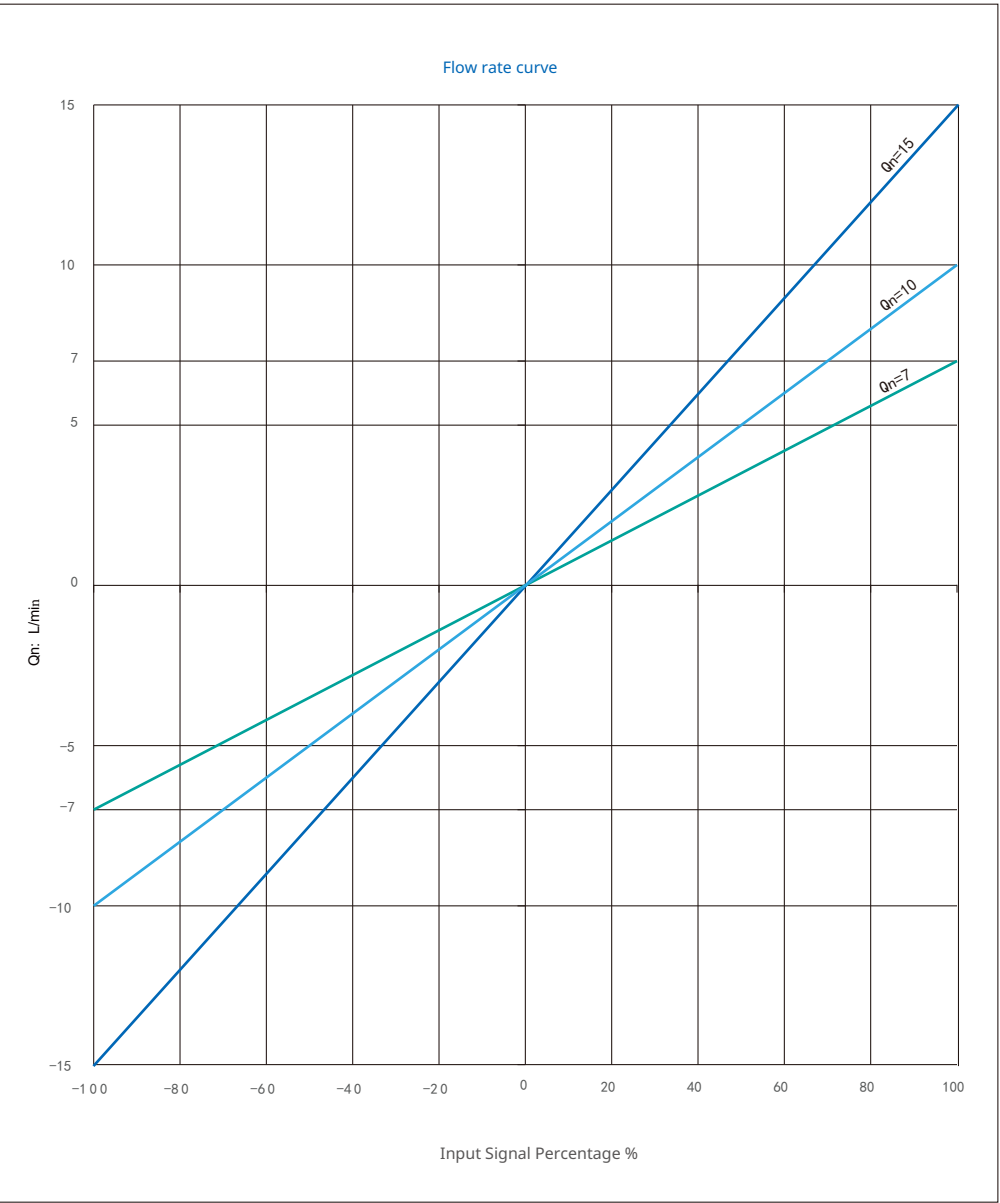
Electrical interface diagram:



Wiring interface diagram

F200 Wiring Diagram	
Red	Power +
Black	Power -
Yellow	Signal +
Green	Signal -

Technical data:



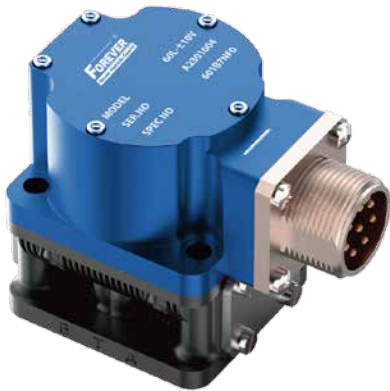
Technical data

General Specification		
Form	Rotary direct-drive servo valve	
Drive	Rotary motor	
Manufacturing process	Additive manufacturing	
Dimensions	Miniature	
Mounting interface	ISO 10372-01-01-0-92	
Contamination resistance	Nas10 grade	
Vibration resistance	(g)	Full shaft 30
Ambient temperature	(℃)	-20 ... +85 (For higher values, please consult customer service)
Weight	(g)	200
Hydraulics		
Maximum working pressure	(Bar)	P, A, B < 350; T < 250;
Hydraulic oil	DIN51524-535	
Fluid temperature	(℃)	-20 ... +85
Viscosity	(cSt)	5 ... 500
Rated flow P = 35 bar on one side	(L/min)	5 / 7 / 10 / 15
Internal leakage at 210 bar	(L/min)	<0. 4
Static / Dynamic		
Step response (100% signal)	(ms)	<4. 0
Frequency response (±25% signal)	(Hz)	>250
Hysteresis	(%)	<1. 6
Dead zone	(%)	<0. 1
Zero drift	(%)	<0. 1

Electrical characteristics

Supply voltage	(V)	22-30 (typical 24/typical 24)
Maximum supply current	(A)	4. 5
Input signal	±20mA / ±10V / 4. . . 20mA	
Electromagnetic compatibility	EN61000-6-2, EN55011:1998+A1	
Plug connector	EN175201-804	

F300 Rotary Direct-Drive Servo Valve



Features

- Independent intellectual property rights
- Compact, miniaturized structure;
- High-pressure resistance, high-frequency response;
- Low internal leakage, contamination resistance;

F300 Rotary Direct-Drive Servo Valve (RDDV) drives the spool to generate linear displacement via a rotary motor, thereby controlling the opening and closing of the valve ports, ultimately achieving precise flow output and driving the load to produce movement.

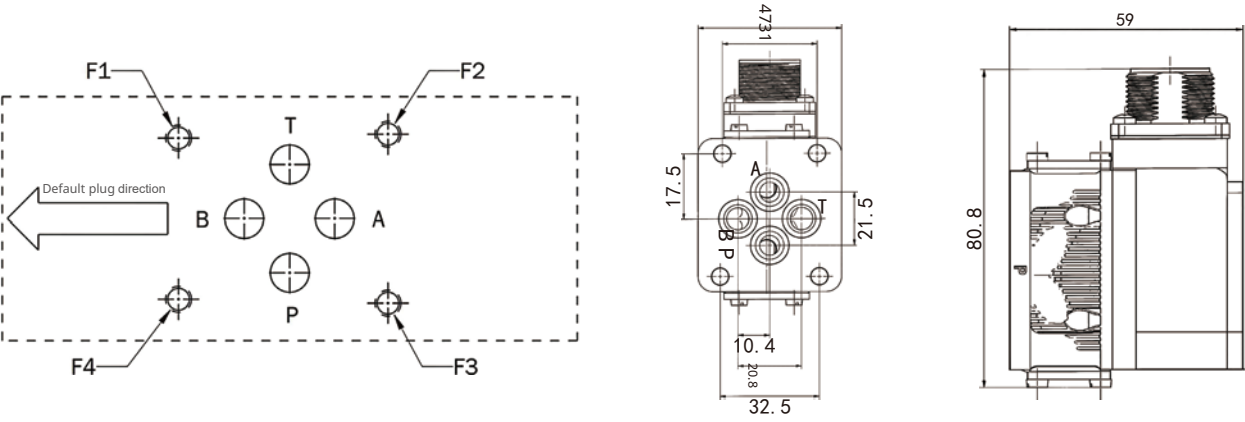
Using metal 3D printing technology to design the valve's core hydraulic structure gives the F300 valve a compact size, lighter weight compared to similar products, ultra-high contamination resistance, and dynamic p
erformance, while continuing the excellent low-pressure performance and high reliability of direct-drive valves.

Product features:



Model selection code F300 - Xa Xb Xc Xd Xe Xf						
a Rated flow (L/min) 1=05 L/min2=10 L/min3=15 L/min4=30 L/min5=40 L/min6=60 L/min						
b Spool neutral position function 1 = zero overlap2 = 3% coverage						
c Input signal 1= +/- 10v2= +/- 20mA 3= 4...20mA						
d Electrical interface 1 = 7-pin2 = 4-pin						
e Sealing material 1 = Nitrile rubber2 = Fluororubber (FKM)						
f Spool position when power is off 1 = no null function2 = null (zero position)3=P→A 15%4 = P→B 15% Example: F300-1-2-1-2-2-1 F300-05 L/min -3% cover - +/- 10V - 4-pin Fluororubber - no null function						
* Customizable upon user request						

Mechanical mounting interface diagram:



Standard reference

EMC standard : EN 61000-6-2

EN55011:1998+A1

Performance test: ISO 10770-1

Hydraulic interface: ISO 4401-03-02-0-05

Screw : F1, F2, F3, F4

Type : M5x40 DIN EN ISO4762-10.9

Installation torque: 7.5 Nm (5.53 ft-lbf)

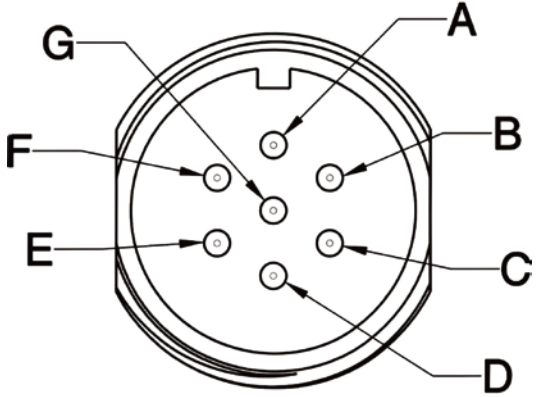
O-ring : P, A, B, T

Type : 9.25xφ1.78 (ISO 3601-1-012) : NBR, EPDM or

Material Viton, 70 Shore A

	P	A	B	T	F1	F2	F3	F4
Diameter φ	mm	7.5	7.5	7.5	7.5	M5	M5	M5
X	mm	21.5	12.7	30.2	21.5	0	40.5	40.5
Y	mm	25.9	15.5	15.5	5.1	0	-0.75	31

Electrical interface diagram:



7-pin interface diagram

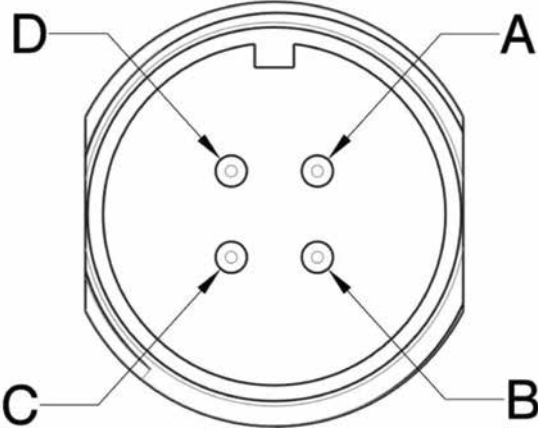
Type	Aviation connector
Number of pins	7
Installation torque	7.5Nm

Pin	Function	Description
A	Power supply +	+24V
B	Power ground	0V
C	-	-
D	Signal +	Differential input signal, +
E	Signal -	Differential input signal, -
F	-	-
G	-	-

1): When the enable function is selected, the function of pin C is enable input. This will override the original pin function.

Note: When the input signal is a current input, the given signal must remain floating and must not exceed 5% of the maximum value; otherwise, it will cause damage to the valve.

Type	Aviation connector
Number of pins	4
Installation torque	7.5Nm

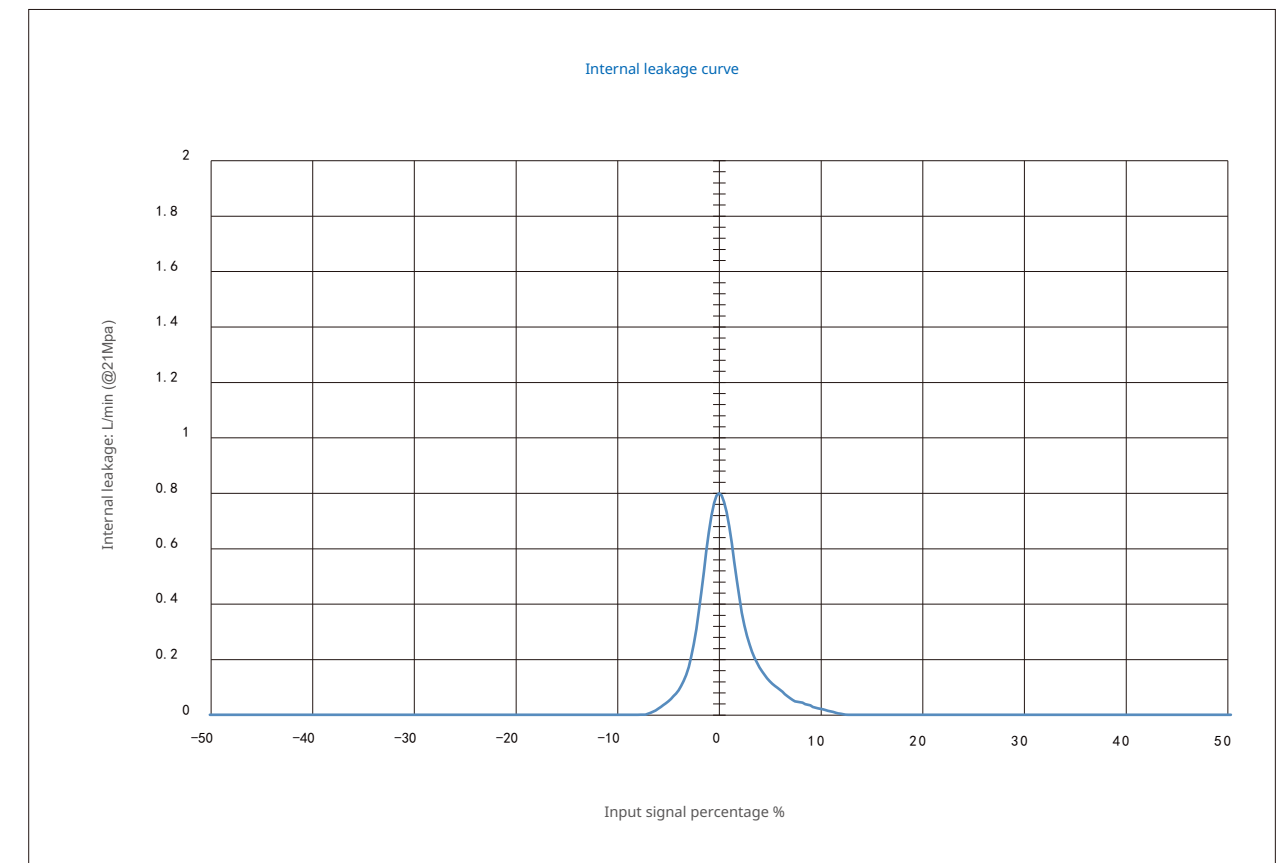
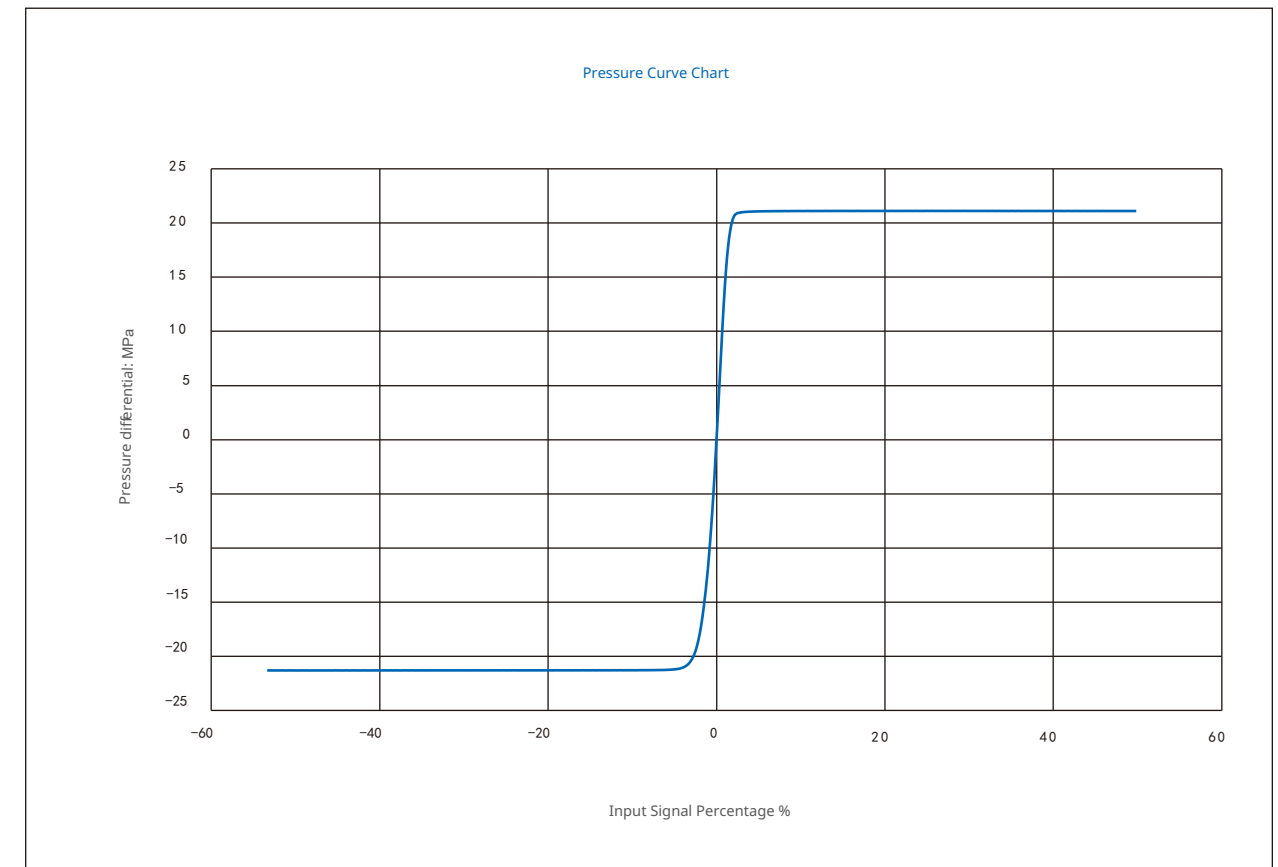
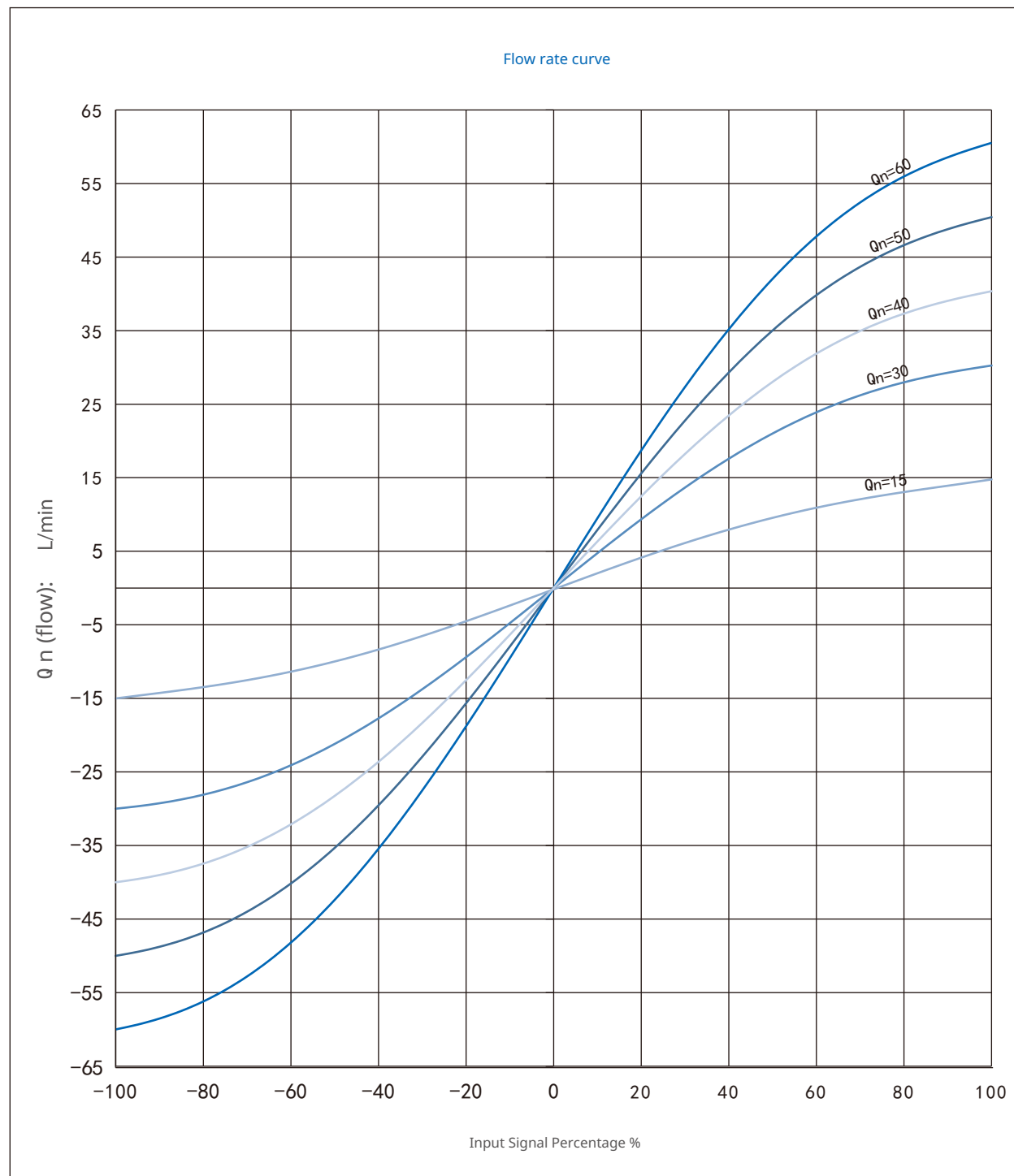


4-pin pinout diagram

Pin	Function	Description
A	Power supply +	+24V
B	Signal +	Differential input signal, +
C	Signal -	Differential input signal, -
D	Power ground	0V

Electrical interface
All connectors comply with EN175201-804/MIL5015 or equivalent sizes, shell size 14.

Technical data:



Technical data

General		
Form	Rotary direct-drive servo valve	
Drive	Rotary motor	
Manufacturing process	Additive manufacturing	
Dimensions	NG6	
Mounting interface	ISO 4401-03-02-0-05	
Contamination resistance	Nas10 grade	
Vibration resistance	(g)	Full shaft 30
Ambient temperature	(℃)	-20 ... +60 (higher range, please consult customer service)
Weight	(g)	500
Hydraulics		
Maximum working pressure	(Bar)	P, A, B < 350; T < 250;
Hydraulic oil	DIN 51524-535	
Fluid temperature	(℃)	-20 ... +80
Viscosity	(cSt)	5 ... 500
Rated flow p = 35 bar single-sided	(L/min)	5 / 10 / 15 / 30 / 40 / 60
Internal leakage at 210 bar	(L/min)	<0. 6
Static / Dynamic		
Step response (100% signal)	(ms)	<3. 5
Frequency response (±25% signal)	(Hz)	>200
Hysteresis	(%)	<1. 8
Dead zone	(%)	<0. 3
Zero drift	(%)	<0. 2
Electrical characteristics		
Supply voltage	(V)	22-30 (typical value 24)
Maximum supply current	(A)	4. 5
Input signal	±20 mA / ±10 V / 4...20 mA (for other requirements, consult the seller)	
Electromagnetic compatibility	EN61000-6-2, EN55011:1998+A1	
Plug connector	EN175201-804	

F400 servo valve



Features

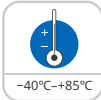
- Independent intellectual property rights
- Compact, miniaturized structure;
- High-pressure resistance, high-frequency response;
- Low internal leakage, contamination resistance;

F400 Rotary Direct-Drive Servo Valve (RDDV) uses a rotary motor to drive the spool to produce linear displacement, thereby controlling the opening and closing of the valve ports and ultimately achieving precise flow output.

F400 valves feature a compact size, the lightest weight among similar products, ultra-high contamination resistance and dynamic performance, while maintaining the excellent low-pressure performance and high reliability of direct drive valves.

The F400 rotary direct-drive servo valve has a universal mounting interface and electrical specifications, winning users' favor in the market with its outstanding performance and competitive price.

Product features:



Temperature Range

EMC

Vibration/Shock resistance

Magnetic field protection

IP protection rating

Short-circuit protection

Reverse polarity protection

Leakage flow

Fast response time

Import substitution

Model selection code

F400 -

X

a

-

X

b

-

X

c

-

X

d

-

X

e

-

X

f

-

X

g

a

Specified at the factory

b

Q N / Rated flow ΔP per throttling edge = 35 bar (500 psi)

1=05 L/min

2=07 L/min

3=10 L/min

4=15 L/min

5=For other requirements, please consult us

c

Spool and sleeve design

1 = zero overlap

2=For other requirements, please consult us

d

Input signal

1= +/- 10v

2= +/- 10mA

3= +/- 20mA

4= 4- 20mA

e

Electrical interface

1 = 4 pins

2 = For its requirements, please consult

f

Sealing material

1 = Nitrile rubber (NBR)

2 = Fluororubber (FKM)

3=For other requirements, please consult us

g

Null position function

1 = Indeterminate, with fail-safe function

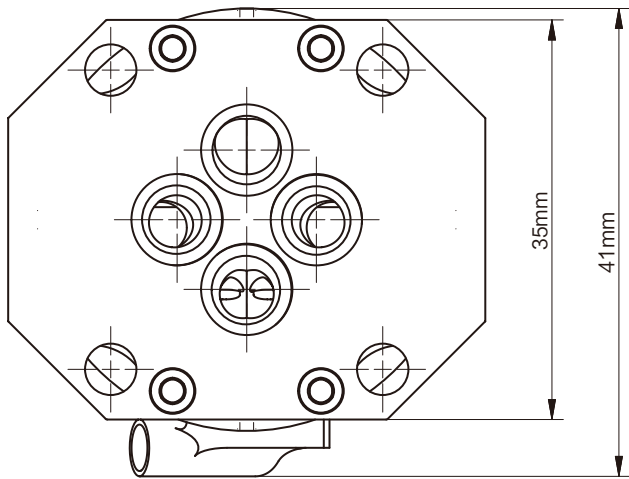
2 = Power-off returns to zero

Example: F400-a-1-1-1-1-1-2

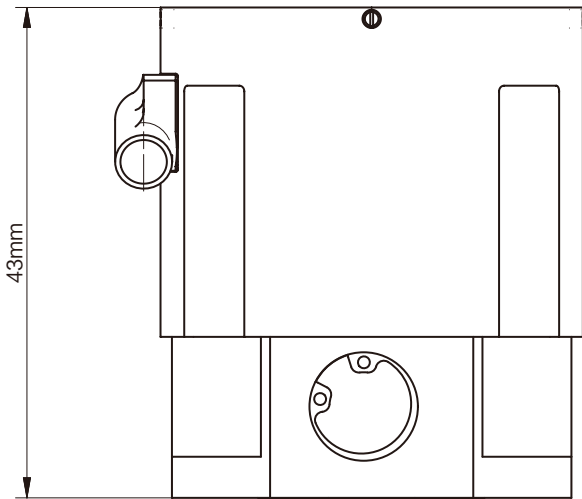
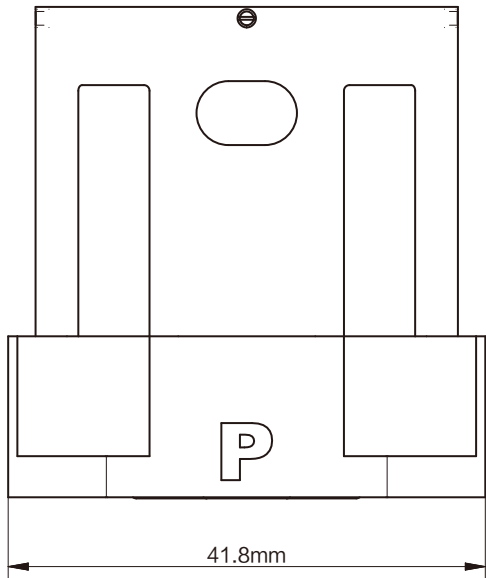
F400-a-05 L/min - zero blanking - +/- 10V - 4-pin - EPDM - power-off zero position

* Customizable upon user request

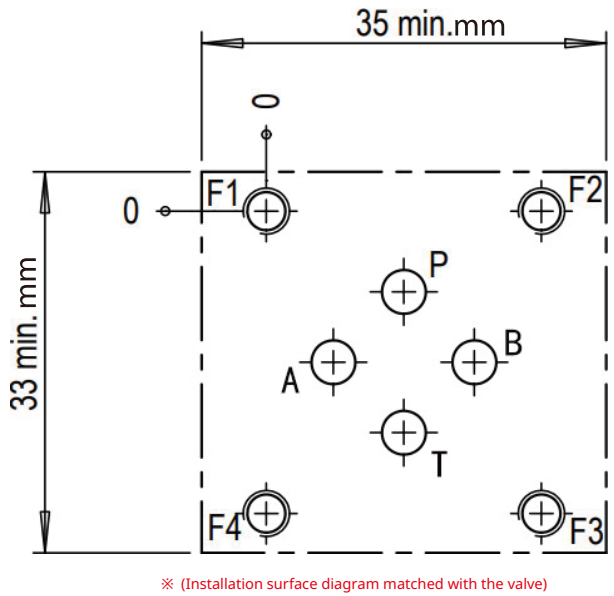
Product dimension drawing:



Notes:
Do not connect port P and port T incorrectly. When port T is subjected to pressure above 10 MPa, it may cause severe damage to the product!



Mechanical mounting interface dimension drawing:

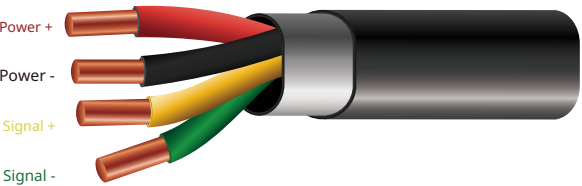


Screws: F1, F2, F3, F4
Type: M4x10 DIN EN ISO 4762-10.9
Installation torque: 3.9 Nm (2.9 ft-lbf)
O-rings: P, A, B, T
Type: $\phi 6.05 \times \phi 1$ (ISO 3601-1-012) Material: NBR, FKM

※ (Installation surface diagram matched with the valve)

Mounting interface complies with ISO 10372-01-01-0-92 (without locating pin)									
		P	A	B	T	F1	F2	F3	F4
Diameter ϕ	mm	$\phi 3.8$	$\phi 3.8$	$\phi 3.8$	$\phi 3.8$	M4	M4	M4	M4
x		11.9	5.8	18	11.9	0	23.8	23.8	0
y		7	13.1	13.1	19.2	0	0	26.2	26.2
Surface flatness within 0.01/100; surface roughness better than 0.8 μm									

Electrical interface diagram

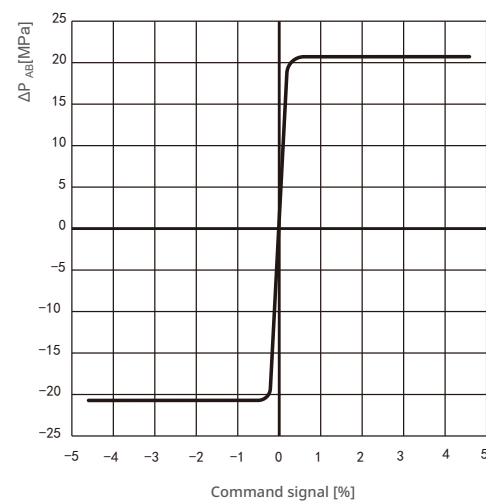


Wiring interface diagram

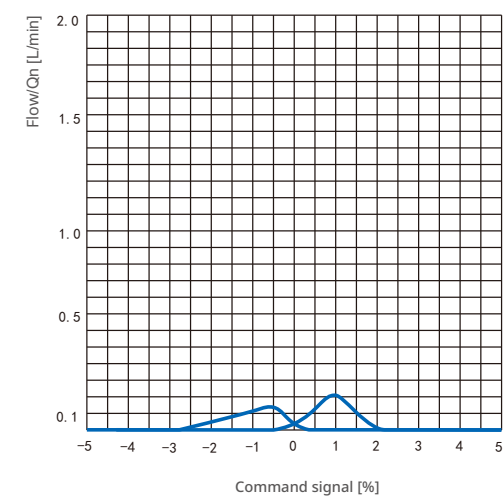
H3e wiring diagram	
Red	Power +
Black	Power -
Yellow	Signal +
Green	Signal -

Technical data:

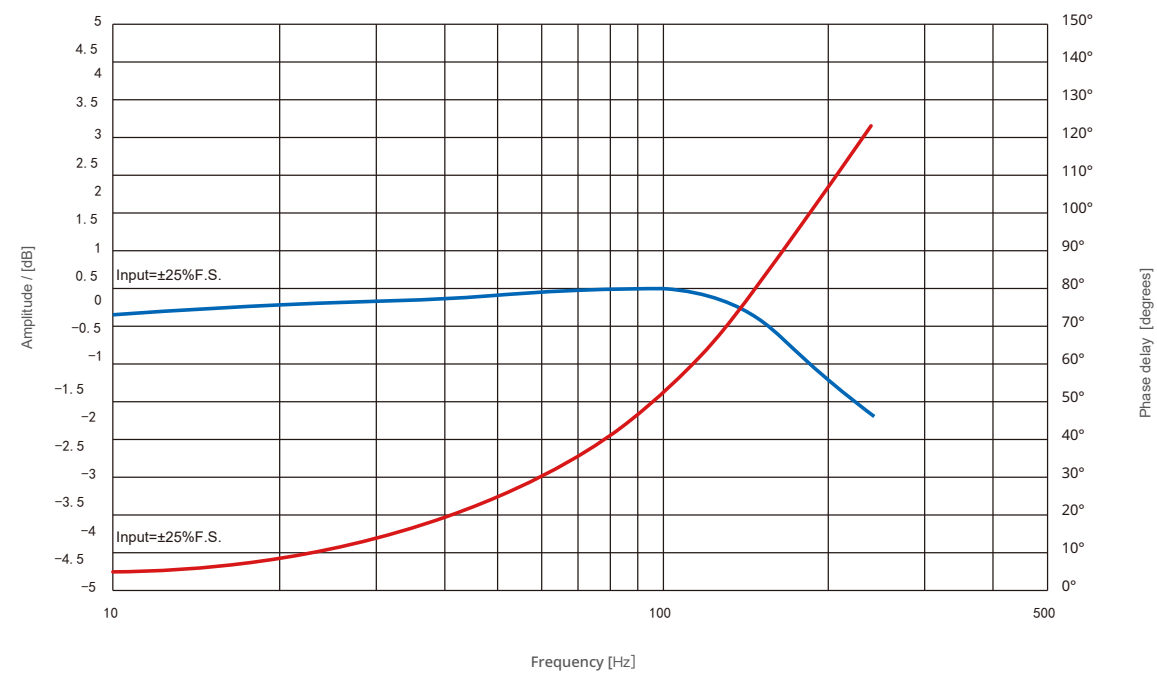
Pressure signal



Leakage flow

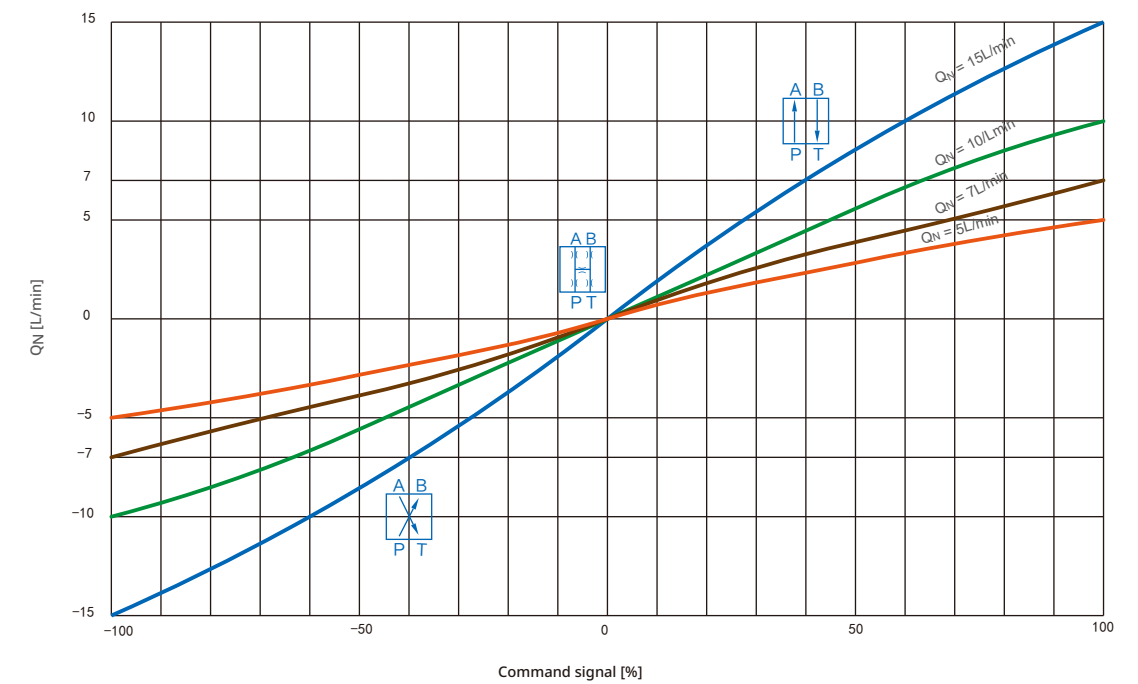


Dynamic characteristics test

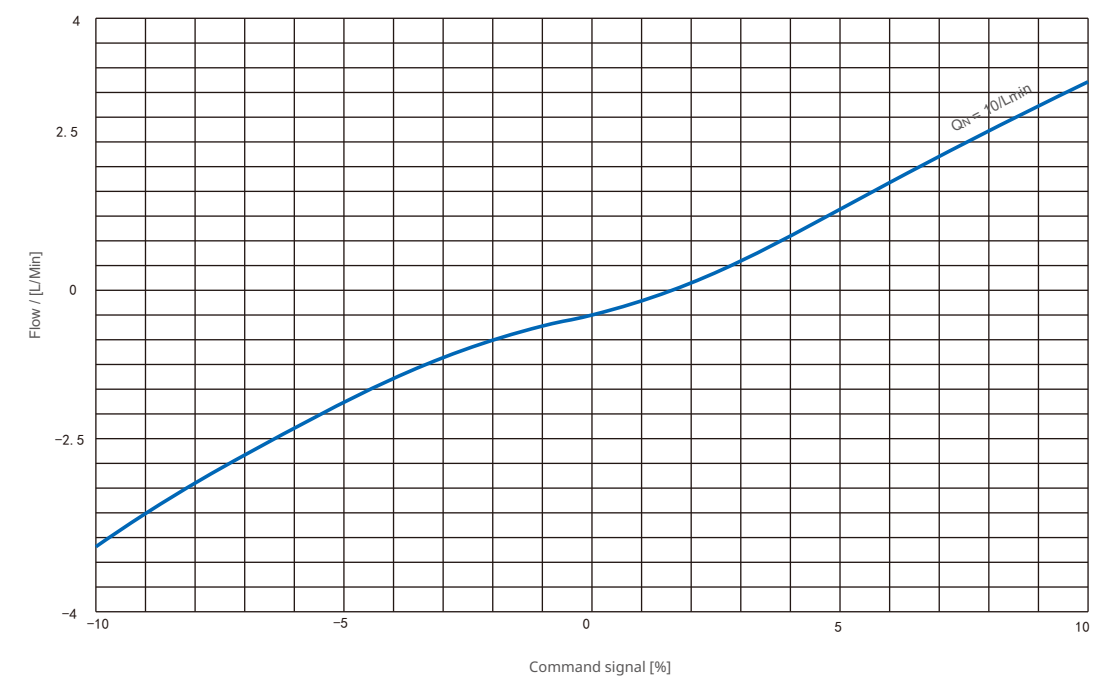


Test curve:

Output Flow-Input Signal Characteristic Test (100% Range)



Output flow-input signal characteristic test (10% of full scale)



Technical data

General		
Configuration	Rotary direct-drive servo valve	
Drive	Rotary motor	
Interface dimensions	Miniature	
Mounting interface	ISO 10372-01-01-0-92	
Contamination resistance	NAS Class 8	
Vibration resistance	(g)	Three-axis 30
Ambient temperature	(°C)	-20 ... +85 (For higher values, please consult customer service)
Dimensions	(mm)	41.8 x 41 x 43
Weight	(g)	204
Hydraulics		
Maximum working pressure	(bar)	P, A, B < 350; T < 100;
Hydraulic oil	DIN51524-535	
Fluid temperature	(°C)	-20 ... +80
Viscosity	(cSt)	5 ... 500
Rated flow ΔP = 35 bar on one side	(L/min)	5 / 7 / 10 / 15
Internal leakage at 210 bar	(L/min)	<0.4
Static / Dynamic		
Step response (100% signal)	(ms)	<2.5
Frequency response (±25% signal)	(Hz)	>200
Hysteresis	(%)	<1
Resolution	(%)	<0.1
Zero offset	(%)	<0.2
Electrical characteristics		
Supply voltage	(V)	22-30 (typical value 24)
Maximum supply current	(A)	3 (stall current)
Input signal	±10V / ±10mA / ±20mA / 4...20mA (please consult for other requirements)	
Electromagnetic compatibility	EN55011-2016+A1	

F661 Servo Valve

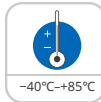


Features

- Using a rotary direct-drive valve as the pilot stage, the leakage flow is reduced by more than 70% compared with traditional jet-pipe and nozzle-flapper pilot stages, greatly lowering the overall valve energy consumption;
- The pilot stage features high responsiveness; in particular, the higher pressure gain results in better dynamic performance of the overall valve;
- The pilot stage has small hysteresis and high resolution; compared with traditional jet-pipe and nozzle-flapper valves, hysteresis is reduced by more than fivefold, delivering a significant improvement in the valve's static performance;
- Compared with jet-pipe and nozzle-flapper designs, the pilot stage allows a lower initial control pressure, further enhancing low-pressure control performance;
- Pilot stage with built-in servo amplifier, easy to adjust and maintain; flexible and versatile control modes; products can be customized for different applications.
- Ultra-high-flow valve body channel design with a wide flow coverage range; pilot-stage control oil can be flexibly selected as internal control or external control according to requirements.

The F661 series is a two-stage electro-hydraulic servo valve in which a rotary direct-drive valve serves as the pilot stage to drive the power-stage spool. The power-stage spool is controlled by a cylindrical slide valve driven by a servo motor, overcoming the drawbacks of traditional jet-pipe pilot stages such as high-pressure jitter, weak contamination resistance, and slow response of mechanical-feedback pilot stages. The performance is more reliable and it is widely used in metallurgy, electric power, testing, and aerospace.

Product features:



Temperature Range



EMC



Vibration/Shock resistance



Magnetic field protection



IP protection rating



Short-circuit protection



Reverse polarity protection



Leakage flow



Fast response time



Import substitution

O-ring seals (included in the standard supply)		Nitrile rubber (NBR) 85 / Fluorocarbon rubber (FKM) 85	
For ports P, T, T2, A, and B	Five	Inner diameter × wire diameter: φ12.42 × φ1.78 mm	
For ports X and Y	Two	Inner diameter × wire diameter: φ15.60 × φ1.78 mm	
Mating plug with protection rating IP65 (included in the standard supply) 6+PE		Complies with EN 175201 Part 804	
		Cable diameter	Minimum 10 mm, maximum 12 mm
Mounting screws (included in the standard supply)		Required torque during installation	Required quantity
M5 x 55 DIN EN ISO 4762 - 10.9		13 Nm	4 pieces

Model selection code

F661

-

X

-

X

-

X

-

X

-

X

-

X

-

X

-

X

-

X

-

X

-

X

-

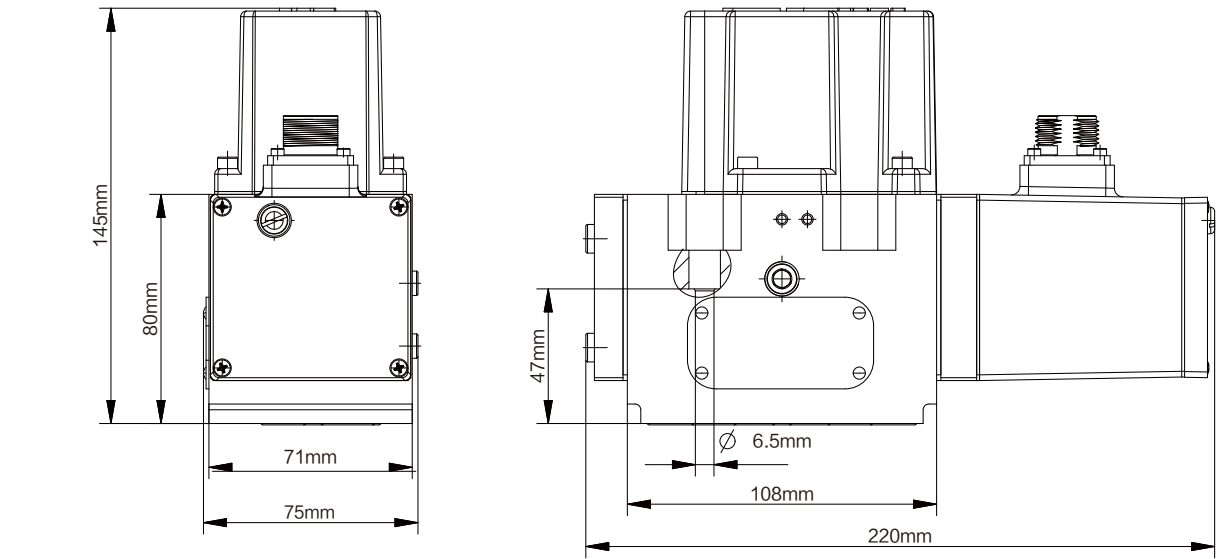
X

-

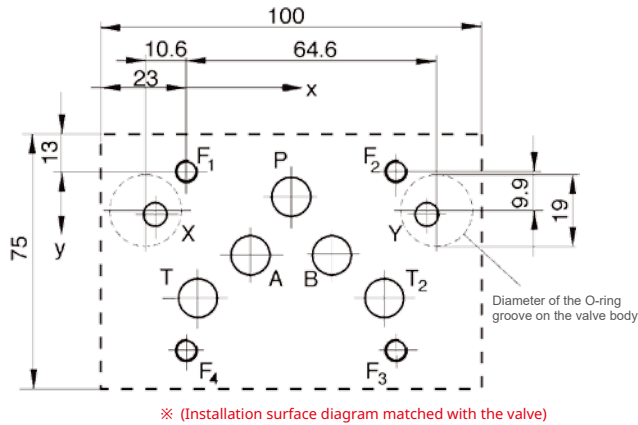
X

a	Q _N / Rated flow ΔP per throttling edge = 35 bar (500 psi) A - Servo valve pressure drop ΔP _N 7MPa								
	1=20 L/min 2=40 L/min 3=80 L/min 4=90 L/min 5=120L/min 6=160L/min 7=200L/min								
	B-1MPa	1=8 L/min	2=15 L/min	3=30 L/min	4=35 L/min	5=45L/min	6=60L/min	7=75L/min	8 = For other requirements, please consult
b	Command signal								
	1= +/- 10v		2 = ±10 V3 = ±10 mA						
c	Input signal								
	1= 2 to 10 V		2= 4 to 20 mA		3= 4 to 20 mA		4 = For other requirements, please consult		
d	Null position function								
	1 = Indeterminate (fail-safe function)		Mechanical fail-safe type		2=P→A, B→T		P _x > 1MPa		3 = P→B, A→T P _x > 1MPa
e	Function code								
	1 = No enable signal input Pin C is unconnected 2 = When there is no enable signal, the main spool moves to an adjustable center position								
	3 = When there is no enable signal, the main spool moves to the A→T or B→T position (the same as when the +24V power supply is cut off)								
f	Control oil connection of the pilot stage								
	1= Internal control internal discharge				2= External control internal discharge				
	3= External control external discharge				4= Internal control external discharge		5=For other requirements, please consult us		
g	Sealing material								
	1 = Nitrile rubber (NBR)								
	2 = Fluororubber (FKM)								
	3=For other requirements, please consult us								
h	Power supply								
	1= 24V _{DC} (18–32 V _{DC})								
	2 = For other requirements, please consult								
i	Valve socket								
	6+PE, Part 804 of EN175201, type R or type S								
j	Pressure range [bar (psi)]								
	Maximum working pressure 35 MPa								
k	Valve dynamic characteristics								
	1 = Standard high-response characteristics								
	2 = Response characteristics can be reduced upon request								
l	Spool and sleeve design								
	1 = Four-way: zero overlap, linear flow gain characteristics								
	2 = For other requirements, please consult								

Product dimension drawing



Mechanical mounting interface dimension drawing※



※ (Installation surface diagram matched with the valve)

Port layout diagram of the mounting face

The minimum mounting length is 100 mm.

Pay attention to the O-ring grooves at port X and port Y.

For a four-way valve, when QN>160 L/min, another non-standard return port T2 must be use simultaneously.

When using the maximum flow, the port diameters P, T, A, and B on the mounting plate are 11.5 mm(there may be deviations from the standard pipe diameter).

The valve mounting surface must achieve a flatness of 0.01 mm for every 100 mm, with an average roughness Ra<0.8 μm.

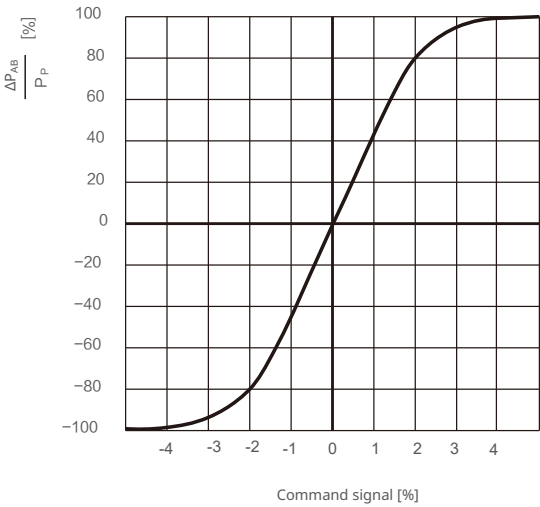
△Notes:

Do not connect port P and port T incorrectly; if port T is subjected to pressure above 10 MPa, the product may be seriously damaged!

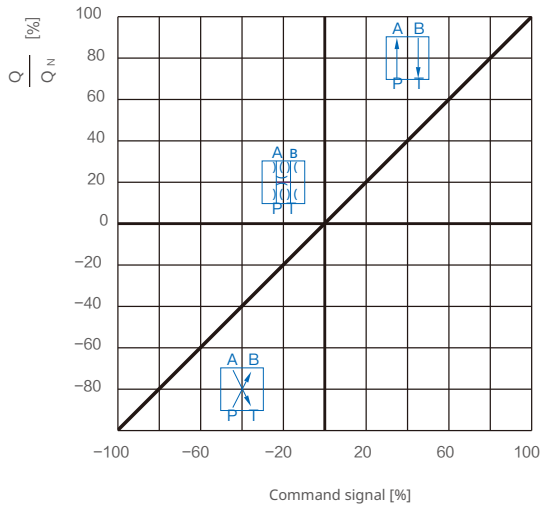
Mounting interface complies with ISO 4401-05-05-0-94											
	P	A	B	T	T ₂	X	Y	F1	F2	F3	F4
Diameter φ mm	11.5	11.5	11.5	11.5	11.5	6.3	6.3	M6	M6	M6	M6
X	27	16.7	37.3	3.2	50.8	-8	62	0	54	54	0
Y	6.3	21.4	21.4	32.5	32.5	11	11	0	0	46	46

Technical data

Pressure signal

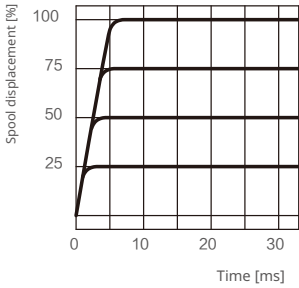


Flow signal

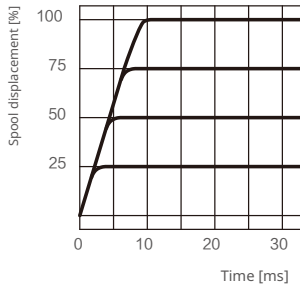


20/90 L/min

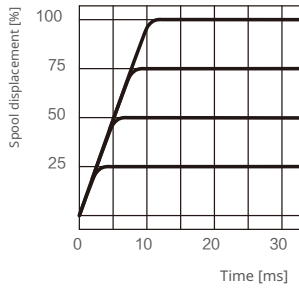
Step response



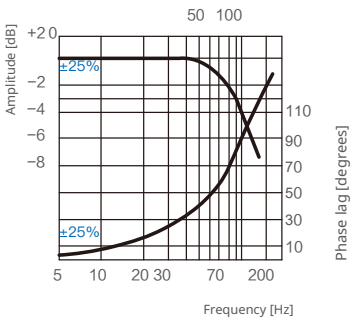
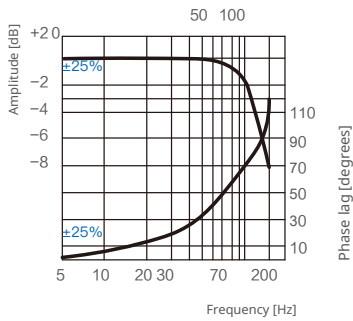
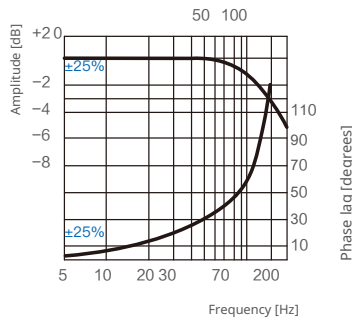
40/80 L/min



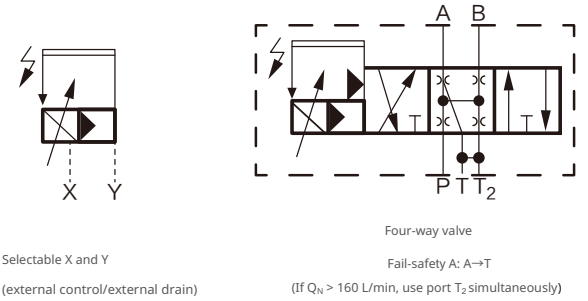
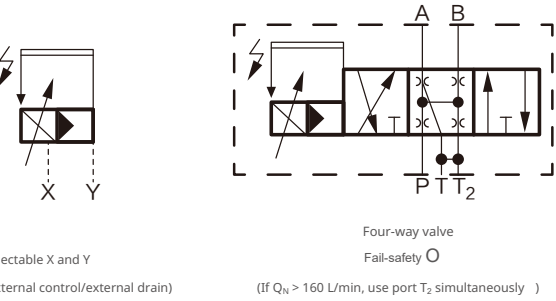
120/160/200 L/min



Frequency response



Technical data



General technical parameters

Sealing ring materials: NBR (nitrile rubber), FKM (fluoroelastomer).

System filtration requirement pilot stage:

Select a high-pressure oil filter (without a bypass valve, with clogging alarm) installed in the main oil line of the system. Install it as close as possible directly at the valve's inlet port.

Main Valve

Select a high-pressure oil filter consistent with the pilot valve. If the system uses a fast-adjusting variable pump, it is recommended to install and use bypass circulation filtration.

Cleanness Class

The cleanliness of the hydraulic oil will greatly affect the operating performance of the servo valve (such as spool positioning, resolution, etc.) and wear conditions (such as throttling edges, pressure gain, leakage, etc.).

Filter element precision Recommended values

General use: $\beta_{15} \geq 75$ (15 μm absolute)

Long-life use: $\beta_{10} \geq 75$ (10 μm absolute)

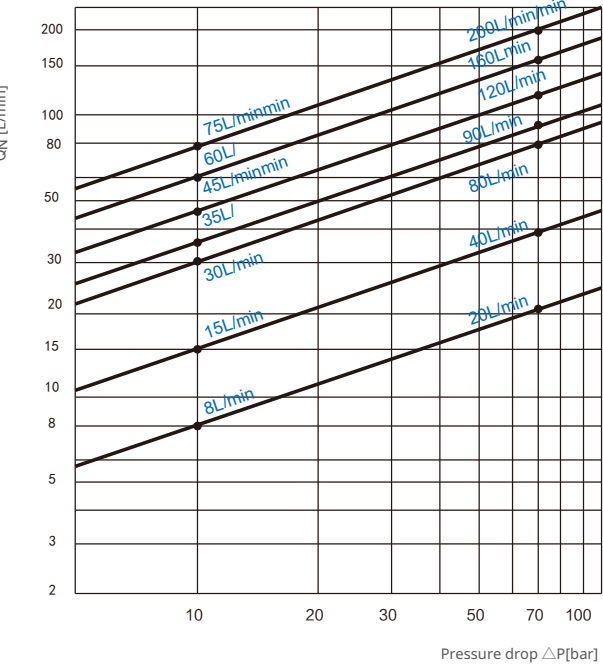
Installation Position Arbitrary, fixed or moving

Vibration 30 g, three axes

Protection rating IP65, Compliant with EN 60529; with the matching plug

Valve load flow characteristics

Relationship curve between the valve's load flow and valve pressure drop when the valve port is fully open (100% given input signal).

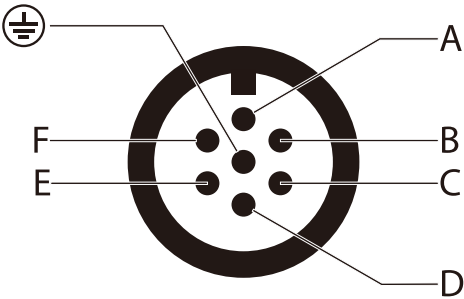


Electrical interface diagram

Pin definition

Pin assignment of valves with 6+PE-level socket, pin contacts (X1)

comply with EN 175201-804; when configuring the plug (type R or S, metal housing), protective earthing (⚡) must be provided in advance.



Electrical data

Pin	Pin assignment	Signal type ¹⁾	
		Voltage range	Current range ²⁾
A	Supply voltage ³⁾	$U_{\text{Supply}} = 24V_{\text{DC}}$ (20 to $28V_{\text{DC}}$), reference ground (reverse-polarity protection ground)	
B	GND/Ground	Power ground Signal ground	
C	Enable signal (code 5, Y) No enable signal (code 5, N)	$U_{\text{EN}} > 8.5$ to $28V_{\text{DC}}$ (referenced to GND): valve ready (enabled) $U_{\text{EN}} < 6.5V_{\text{DC}}$ (Referenced to GND): valve disabled Input resistance is 10 k Ω	
D	Input signal (differential)	$U_{\text{in}} = U_{\text{D}} - U_{\text{E}}$ $R_{\text{in}} = 10\text{k}\Omega$	$I_{\text{in}} = I_{\text{D}} - I_{\text{E}}$ $R_{\text{in}} = 200\Omega$ $I_{\text{max}} = \pm 25\text{ mA}$
E	Input command ground (differential)	Pin D ⁴⁾ ground)	
F	Spool position feedback	$U_{\text{F-B}} = 2$ to 10V; $U_{\text{F-B}}$ is proportional to the spool position; 6V corresponds to the spool center position; $R_{\text{L}} = 500\Omega$.	$I_{\text{out}} = 4$ to 20 mA, reference ground. I_{out} is proportional to the spool position; 12mA corresponds to the spool center position. Output has short-circuit protection; $R_{\text{L}} = 0$ to 500 Ω .
⚡	Protective earth (PE)	Connect the valve body	

Note:

1) See ordering information for signal ranges.

2) Command signal $I_{\text{in}} < 3\text{ mA}$ (for example, due to cable break) indicates failure of the 4 to 20 mA signal.
The customer can customize and activate the valve's response to this fault.

3) All connected circuits must be isolated from the mains by "electrical isolation" in accordance with IEC/EN 61558-1 and IEC/EN 61558-2-6, with voltage limited to the safety extra-low voltage range specified in EN 60204-1. We recommend using SE LV/PELV power supplies.

4) The potential difference between pin D or E and pin B must be between -15 and +28 V.

General

Form Electro-feedback servo valve

Valve type Four-way main valve with custom-made spool and sleeve

Drive Rotary Direct Drive Pilot Control

Manufacturing process Machining

Interface dimensions DN10

Mounting interface Compliant with ISO standard, with an extra T port ISO 4401 - 05 - 05 - 0 - 94

Contamination resistance Typically NAS class 8
Longer service life (wear condition) NAS class 6

Vibration resistance (g) Three-axis 30

Ambient temperature ($^{\circ}\text{C}$) -20 to +60

Dimensions (mm) 220 x 75 x 145

Weight (Kg) 5.7

Hydraulics

Operating pressure range Ports P, A, and B $\leq 35\text{ MPa}$

Ports T and T₂ (internal drainage of pilot control oil) $\leq 21\text{ MPa}$

Ports T and T₂ (external drainage of pilot control oil) $\leq 35\text{ MPa}$

Maximum working pressure (bar) 350

Hydraulic oil Petroleum-based hydraulic oil (standard according to DIN 51524 Parts 1–3), or selected according to user requirements.

Fluid temperature ($^{\circ}\text{C}$) -20 to +80

Viscosity (cSt) Recommended value 15–100 mm²/s Permissible value 5–400 mm²/s

Q_{N} /Rated flow (L/min) 20 / 40 / 80 / 90 / 120 / 160 / 200
 ΔP per throttling edge = 35 bar (500 psi) [per throttle edge at ΔP of 35 bar (500 psi)]

Internal leakage at 210 bar (L/min) < 1.5

Maximum flow rate (L/min) 250 (ISO 4401 size 05, connect the second T port)

Static/Dynamic

Step response (100% signal) (ms) <12 (this value depends on the rated flow)

Frequency response ($\pm 25\%$ signal) (Hz) >85 (this value depends on the rated flow)

Hysteresis (%) <0.3

Resolution (%) <0.05

Zero offset (%) <2 ($\Delta T = 55\text{ K}$)

Electrical characteristics

Supply voltage (V) 24 VDC (18 to 32 VDC)

Input signal $\pm 10\text{V} / \pm 10\text{mA} / 4\text{--}20\text{mA}$

Electromagnetic compatibility EN55011-2016+A1

Hydraulic servo power unit

- Small Hydraulic Servo Power Unit
- Standard Hydraulic Servo Power Unit
- Silent Power Unit
- Hydraulic Oil Distribution Substation
- Large Hydraulic Power Unit



Small Hydraulic Servo Power Unit

Pump-Controlled Servo Hydraulic Power Unit



- Compact structure, high degree of integration
- Noise ≤ 60 dB (more comfortable operating environment)
- Stepless pressure adjustment
- Stepless flow adjustment
- Servo motor-driven gear pump

Suitable for long-duration pressure-holding conditions, with self-adaptive speed and energy-saving consumption.

Cooling

Standard air-cooled heat exchange

Oil power unit dimensions

540 mm x 540 mm x 760 mm (L x W x H)

Low noise

Adopts an integrated motor-pump noise reduction measure.
All pipelines use acoustic treatment structures to reduce fluid noise.



Product features:



Bus



Touch



Energy saving



Compact structure



Low noise

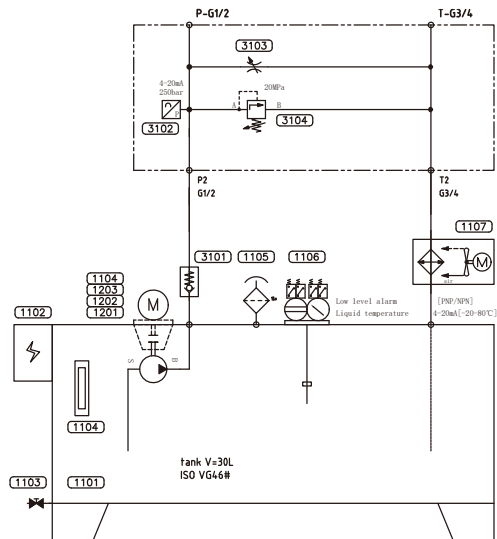
Selection code:

FS-HPU30 - X - X - X - X - X				
a	b	c	d	e
1: 250 bar	1: 6 L/min	1: 5.5 kW	1: Air cooling	1: 30 L
	2: 8 L/min	2: 7.5 kW	2: Oil cooling	2: 50L
	3: 10 L/min			3: 100L
	4: 12 L/min			

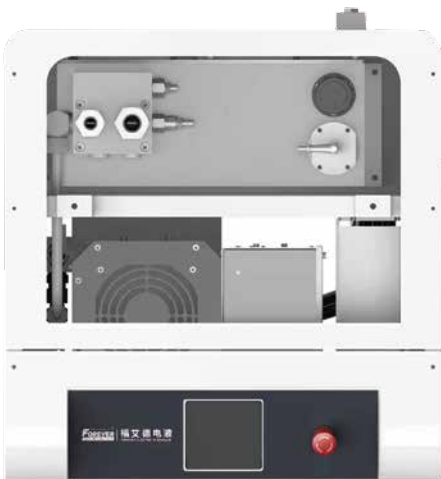
Example: FS-HPU30-1-1-2-1-1

FS-HPU30-250-6-7.5-Air-cooled-30

Principle Diagram:



Outline Diagram:



Specifications:

Model	FS-HPU30-1	FS-HPU30-2	FS-HPU30-3	FS-HPU30-4
Flow L/min	6	8	10	12
Noise dB(A)	60	60	60	60
Tank capacity L	30	30	30	30
Length mm	540	540	540	540
Width mm	540	540	540	540
Height mm	760	760	760	760
Weight kg	55	55	55	55
Input power kW	5.5	5.5	5.5	7.5
Number of motors	1	1	1	1

Standard Hydraulic Servo Power Unit

FN-HPU



Advantages and Features

- Compact structure, modular design, short delivery lead time
- Noise level ≤75 dB [within 1 meter]
- Two-stage oil filtration 5μ, 10μ
- Cooling method: water-cooled heat exchange
- Equipped with an intelligent hydraulic lifecycle monitoring system
- Integrated hydraulic power unit electrical control [optional]

Servo power unit is a standardized power unit based on a modular servo motor pump group, suitable for all fields that use hydraulic solutions and require pressure and flow supply units—for example, metal cutting machine tools, woodworking machines, presses, plastic processing machines, etc.

Product features:



Bus



Touch



Energy saving



Compact structure



Low noise

Selection code:

FN-HPU - X - X - X - X			
a	b	c	d
Volume	Pressure	Flow	Cooling method
1: 150 L	1: 160 bar	1: 13.6 L/min	1: Air cooling
2: 350 L	2: 210 bar	2: 17 L/min	2: Water cooling
3: 420L	3: 250 bar	3: 22.1 L/min	3: Oil chiller
4: 600L		4: 27.2 L/min	4: Integrated cooling
		5: 34 L/min	
		6: 42.5 L/min	
		7: 54.4 L/min	
		8: 68 L/min	
		9: 85 L/min	
		10: 107 L/min	

Example: FN-1-2-3-1

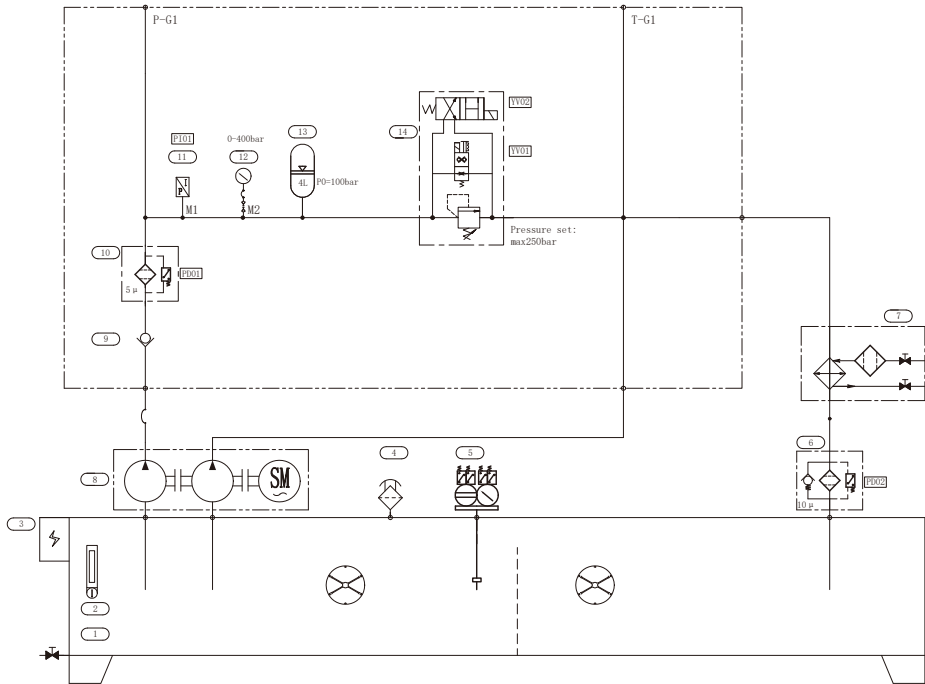
FN-150L-210bar-22.1L/min-Air Cooling

*Note: For hydraulic power units requiring higher flow rates, please contact Forever for customized support!

Technical Parameters

No.	Product Code	Output Volume	High-Pressure Flow [max]	Pressure [max]	Installed Power	Servo motor Rated torque	Volume L
		cc/r	L/min	MPa	kw	N*m	
1	FN-HPU-1-3-1	8	13.6	25	8	45	150L
2	FN-HPU-1-3-2	10	17	25	8	55	
3	FN-HPU-1-3-3	13	22.1	25	11.6	65	
4	FN-HPU-2-3-4	16	27.2	25	16	90	350L
5	FN-HPU-2-3-5	20	34	25	19.6	110	
6	FN-HPU-2-3-6	25	42.5	25	24.9	140	
7	FN-HPU-3-3-7	32	54.4	25	28.5	160	420L
8	FN-HPU-3-3-8	40	68	21	32	180	
9	FN-HPU-4-3-9	50	85	21	41.8	235	600L
10	FN-HPU-4-3-10	63	107	21	51.6	290	

Schematics



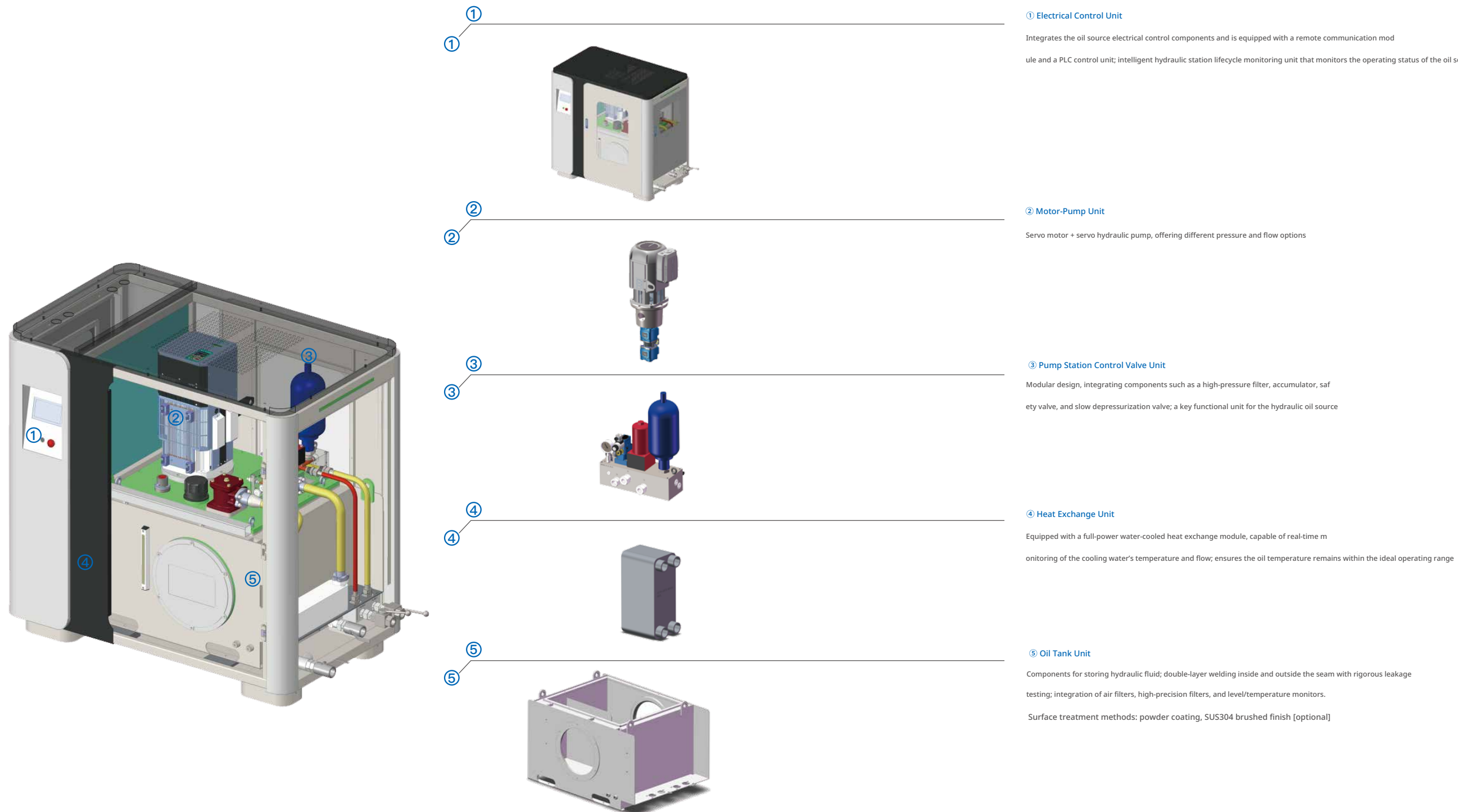
Technical Parameters

(For application requirements beyond these parameters, please consult the company)

Hydraulic oil				Mineral oil HLP according to DIN 51 524 Part 2 For operating temperature of 50°C ISO VG46 DIN 51 519 (Other hydraulic oils as specified)
Pump model				Internal gear pump AGP series
Motor-pump unit				Servo motor + servo oil pump
Filtration/Cooling circulation module				Two-stage filtration: 5μ + 10μ; water-cooled heat exchange module
Operating pressure (absolute value)	Inlet	Pmin-max	bar	0.8 to 30
	Outlet	Pmax	bar	280
	Drain port	Pmin-max	bar	2
Hydraulic oil temperature range		ø	°C	-25 to 70°C
				When operating with mineral oil HLP according to DIN 51 524, the optimal operating temperature range for the hydraulic pump station is 40°C and 50°C. During continuous operation, the working temperature must not exceed 70°C.
Oil cleanliness class according to ISO standard				The maximum oil contamination level is according to ISO 4406 (C) and according to the requirements of the hydraulic system ¹⁾
Safety pressure				250
Viscosity range		v	mm ² /s	Optimal range is 16 to 36
		v	mm ² /s	Short-term from 10 to 1000
Motor model				AC permanent magnet servo motor
Voltage		u	v	380/440 [For other requirements, please consult the company]
Rotational speed		n	min ⁻¹	max2000
Protection rating				IP55
Direction of rotation				Counterclockwise (as viewed from the M drive shaft)
Oil filter	Air filter		μm	10
	Return oil filter		μm	10
Surface protection		High-pressure filter	5μm	Painted with epoxy resin paint according to RAL 5009 (RN 123.01)
Piping system model				Installed according to DIN 2353 light/heavy series models

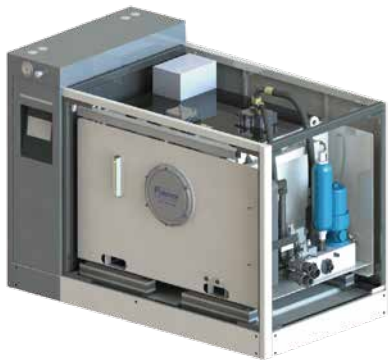
¹⁾ In a hydraulic system, the required cleanliness level of the components must be achieved; effective filtration prevents problems and also extends the service life of the components.

Servo power unit components



Silent Hydraulic Servo Power Unit

SHPU



- Compact structure, full stainless-steel enclosure
- With pressure, temperature, liquid level, and filtration alarm display Noise
- ≤72 dB (more comfortable operating environment)
- Very high oil filtration grade 3 μm
- Equipped with a self-circulating cooling and purification device
- All panel surfaces use baked paint finishing
- The pump station supports both remote and local control modes



Product features:



Bus



Touch



Energy saving



Compact structure



Low noise

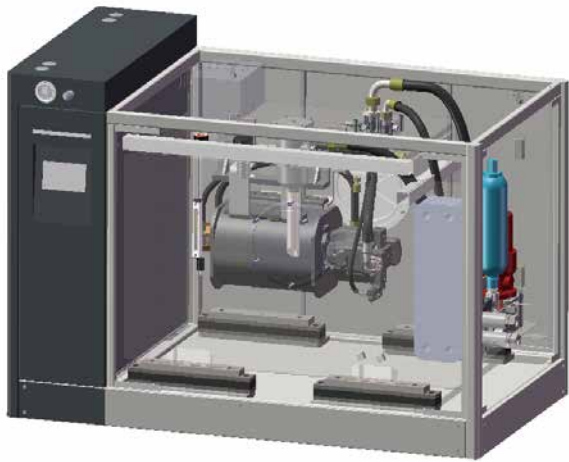
Selection code:

SHPU - X - X - X			
a	Rated pressure	b	Flow
	1: 21 MPa	1: 40 L/min	7: 500 L/min
		2: 65 L/min	8: 600 L/min
		3: 100 L/min	9: 1200 L/min
		4: 200 L/min	10: 1200 × n L/min
		5: 300 L/min	
		6: 400 L/min	

Example: SHPU-N-1-4-d
SHPU100N-400L-21-200L-Water cooling

*Note: For hydraulic power units requiring higher flow rates, please contact FuAide for customization support!

Layout diagram:



Notes:

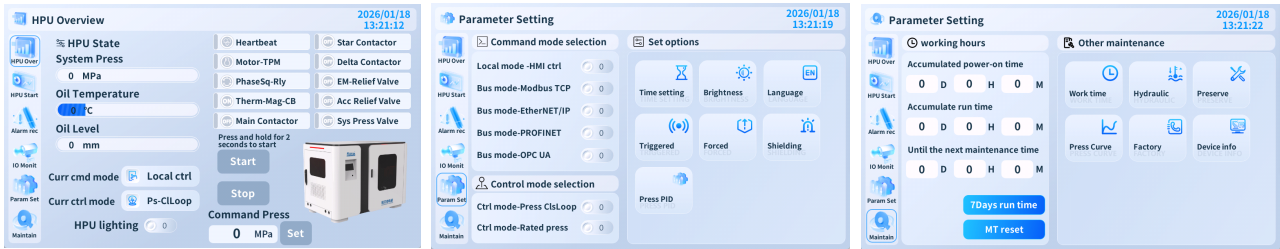
- The silent oil power source has undergone rigorous testing and performance inspection within the factory, and no modifications or alterations are permitted; otherwise, the warranty will be void.
- Repairs to the hydraulic power unit may only be carried out by the manufacturer or authorized professionals. Our company will assume no warranty responsibility for any repairs performed by customers themselves.

Advantages and features:

The noise level of the entire series of servo silent hydraulic power units does not exceed 72 dB (distance 1 m, free-field test)

For the sources of hydraulic power unit noise, we adopt the following noise reduction measures:

- Apply acoustic treatment to the metal enclosure.
- Adopts an integrated motor-pump noise reduction measure.
- All piping uses acoustically treated structures to reduce fluid noise.
- Full lifecycle monitoring unit



Modular design concept

The hydraulic power unit is configured with a 100 L/min base module, which can be paralleled to obtain silent hydraulic power unit products with greater flow (maximum flow is 1200 L/min)

Full-power heat dissipation design

A water cooler with full-power heat dissipation is built into the base module of the hydraulic power unit system, and the water supply to the cooler is controlled via an automatic water valve based on oil temperature. This not only maintains an ideal operating state for the power unit, but also minimizes cooling water consumption for users, significantly reducing operating costs.

Oil cleanliness function

The base module of the hydraulic power unit is equipped with an automatic cleaning circulation system and an oil sampling point. After the customer replaces the oil, independent circulation filtration can be performed to improve the cleanliness The setup of sampling points makes it convenient for users to monitor changes in oil cleanliness and physicochemical properties at any time, enabling accurate judgment of whether the oil should be replaced.

High efficiency and energy saving

- Using a variable pump system, when no external work is being performed, the pump has zero swash angle, so the motor operates at minimal power. This saves energy and also reduces heat generation.
- Employ variable flow control, starting different numbers of oil source modules as needed, to save the maximum amount of electrical energy for the user.

Specifications:

No.	Product Code	output Volume	Rotational [Rated]	Flow speed [max]	Circulating flow [max]	Pressure [max]	Installed Power	Noise	Oil source dimensions Length*Width*Height	Volume L
		CC/r	r/min	L/min	L/min	Mpa	KW			
1	SHPU1-1	28	1450	40	20	21	22	<70DB	1750*1050*1270	400
2	SHPU1-3	71	1450	100	20	21	45	<70DB	1750*1050*1270	400
3	SHPU1-4	71*2	1450	200	40	21	45*2	<70DB	3110*1460*1805	800
4	SHPU1-5	71*3	1450	300	60	21	45*3	<70DB	3620*1460*1805	1200
5	SHPU1-6	71*4	1450	400	80	21	45*4	<70DB	4130*1460*1805	1600
6	SHPU1-7	71*5	1450	500	100	21	45*5	<70DB	4640*1460*1805	2000
7	SHPU1-8	71*6	1450	600	120	21	45*6	<70DB	5150*1745*1805	2400



Layout diagram:

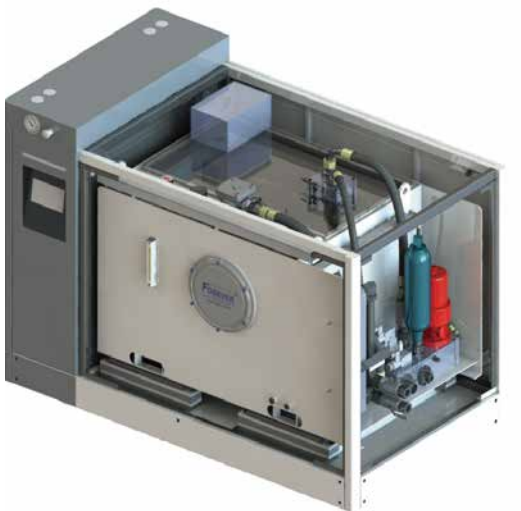
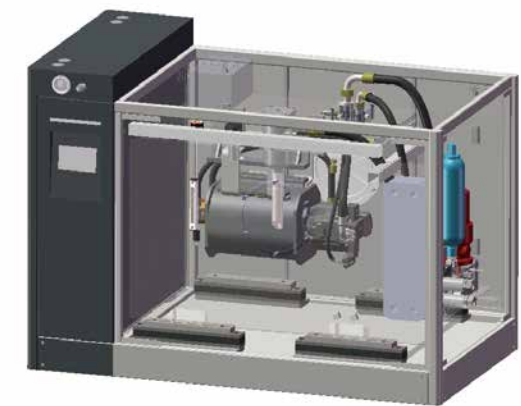


Power module that can be integrated and easily expanded

The FS silent oil source series is equipped with a base module providing a flow rate of 100 L/min, which can be enhanced with the simplest expansion methods to increase flow—either by adding a pump group module or by directly adding a hydraulic power source—to meet the needs of continuously evolving test requirements.

Easy to maintain and operate

The FS silent oil source series runs quietly, is easy to maintain, and is lower than traditional hydraulic power sources, making it easier to operate. It adopts an easily removable baffle frame structure, providing better noise isolation and facilitating maintenance. Meanwhile, the oil-immersed motor pump set uses a hoisting structure, so during maintenance you only need to hoist out the motor pump set to carry out repairs and servicing on the pump set, making it quicker and more convenient.



The FS silent hydraulic power unit series can effectively help users extend system service life, improve overall testing efficiency, and reduce testing noise.

Features:

High efficiency and energy saving

The FS silent hydraulic power unit series uses a variable pump system. When no external work is being performed, the pump is at zero swash angle, allowing the motor to run at minimum power. This saves energy and reduces system heat generation, while the recirculating cooling system maintains a reasonable operating temperature for the hydraulic power source.

Quiet, clean, compact

According to customer needs, the FS silent hydraulic power unit series offers different power models. The system uses an oil-immersed motor as the driving power; the entire power assembly is immersed in hydraulic oil, resulting in a compact structure and effectively reducing the noise of the power unit. Its noise level is far lower than that of traditional hydraulic power sources, with fewer external pipelines, greatly reducing the risk of oil leakage and making it cleaner than traditional power sources.

Remote monitoring

The FS silent hydraulic power unit series is equipped with an integrated information monitoring device to facilitate control of the hydraulic power source and display status information. The Fuaide hydraulic station full life-cycle monitoring system can remotely display the system's operating status. Whether in the control room, office, or at home, you can monitor system status via a smart terminal. For a single hydraulic power source, a remote control terminal device allows operation of the hydraulic power source from any location specified by the user, with a unified graphical interface, comprehensive information display, and functional operations. With these devices, test operators do not need to leave the test site to go to the hydraulic power unit room to check the operating status or change settings; all functions can be conveniently performed remotely, greatly improving efficiency.

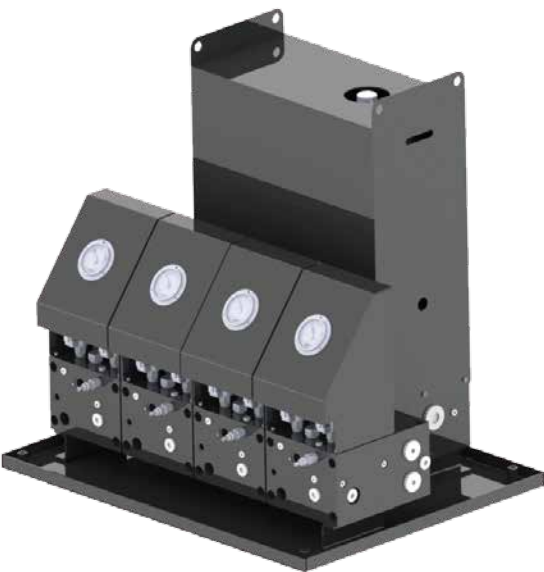
Hydraulic Oil Distribution Substation

FHDM

Forever Hydraulic Flow Distribution Substation is specially designed for testing single-action actuators. The Forever hydraulic substation (FHDM) allows the actuator to be isolated from the power unit and other actuating components via the hydraulic substation. It is designed to operate at hydraulic system pressures of 210 bar or 280 bar, with a maximum rated flow range of 40 to 320 L/min, and can connect up to 4 control stations. FHDM can provide a diversion system for the test system with switch/low-pressure/high-pressure control, thereby establishing smooth high/low pressure switching and avoiding damage caused by shocks during high/low pressure transitions.

Safety: provides a pressure safety valve to keep the actuator operating within a safe pressure range.

Isolation: using a single pilot control, the actuator can be completely isolated from the rest of the hydraulic circuit and its motion can be stopped immediately.



Product features:



High/low pressure switching



Safety



Isolation



Compact structure



Pressure Regulation

Ordering and selection:

FHDM - X_a - X_b - X_c - X_d - X_e								
a	Rated flow		b	Pilot control		c	Rated pressure	
1: 40 L/min			0: no pilot function			1: pressure range 210 bar		
2: 160 L/min			1: with pilot function and shut-off valve			2: pressure range 280 bar		
3: 320 L/min			2: with pilot function without shut-off valve					
d	Accumulator volume							
B2: 2.5 L/1 L corresponding to 40/80 L/min								
D3: 6 L/2.5 L corresponding to 160/320 L/min								

Technical Parameters

Specifications	FHDM40	FHDM80	FHDM160	FHDM320
Number of substations	1 to 4	1 to 4	1 to 3	1 to 2
Rated flow	40L/min	80L/min	160L/min	320L/min
Low-pressure setting	35bar	35bar	35bar	35bar
	Electromagnetic control			
Low-voltage control	is	is	is	is
High-voltage control	is	is	is	is
Voltage	24VDC	24VDC	24VDC	24VDC
Maximum current	1A	1A	1A	1A
	Filtration			
Pressure oil	5μm	5μm	5μm	5μm
	Accumulator			
Main oil circuit	2.5L	2.5L	6L	6L
Pilot oil circuit	NA	NA	0.5L	0.5L

Technical Parameters

Oil temperature	24 to 57°C
Medium	ISO VG 32 or ISO VG 46 or media with equivalent performance
Cleanliness	ISO 4406(SAEJ1165) 15/14/11 (NAS 5)
Sealing material	NBR
Maximum pressure (factory setting)	315bar

Large Hydraulic Servo Power Unit

Large hydraulic oil source

FB-HPU



Advantages and Features

- Compact structure, modular design, short delivery lead time
- Noise level ≤85 dB [within 1 meter]
- Two-stage oil filtration 5 μm, 10 μm
- Cooling method: water-cooled heat exchange
- Equipped with an intelligent hydraulic lifecycle monitoring system
- [optional] Integrated hydraulic power unit electrical control [optional]
- Integrated Control Pump Unit [Optional]

Large Hydraulic Oil Power Source is a modular standard power unit based on a combination of a three-phase asynchronous motor + variable oil pump/servo motor + internal gear pump. It is suitable for all fields that use hydraulic solution supply units, such as metallurgy, petrochemicals, and the testing industry.

Product features:



High Pressure



High flow rate



Stability



Compact structure



Pressure Regulation

Selection code:

FB- HPU - X - X - X		
a	b	c
Flow	Pressure	Cooling method
1: 200 L/min	1: 210 bar	1: Water cooling [standard configuration]
2: 400 L/min	2: 250 bar*	2: Oil chiller
3: 600 L/min	3: 280 bar*	
4: 800 L/min		
5: 1000 L/min		

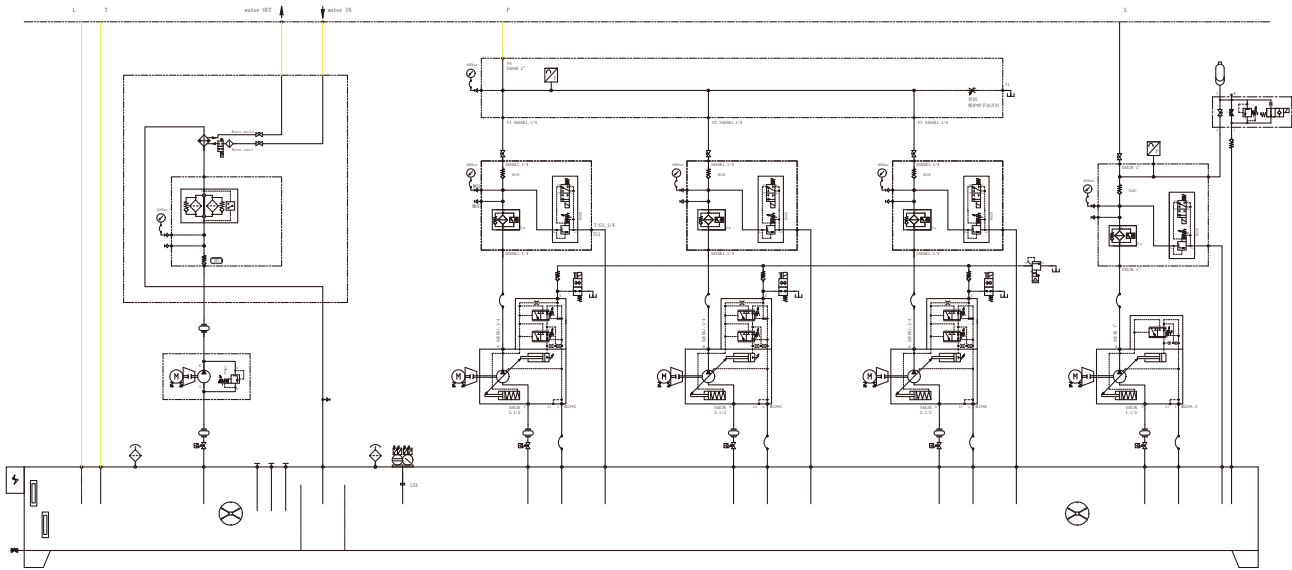
Example: FB-HPU-1-3-1
FB-HPU-200-280-water cooling

*Note: For hydraulic power units requiring higher flow rates, please contact Forever for customization support!

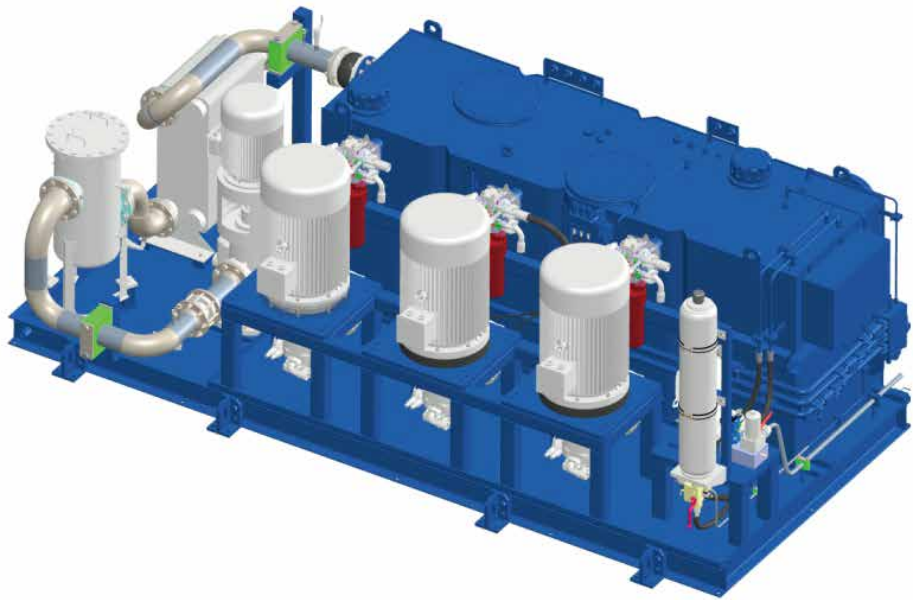
Technical parameters (using 210 Bar as an example)

Product Code	Volume	Speed [max]	Flow rate [max]	Pressure [max]	Installed Power	Dimensions		
	L	r/min	L/min	Mpa	kw	L	W	H
FB-HPU1-1	3200	1500	200	21	90	2800	2200	1900
FB-HPU2-2	4500	1500	400	21	180	3800	2200	1900
FB-HPU3-3	5800	1500	600	21	270	4800	2200	1900
FB-HPU4-4	7100	1500	800	21	360	6000	2200	1900
FB-HPU5-5	8400	1500	1000	21	450	7500	2200	1900

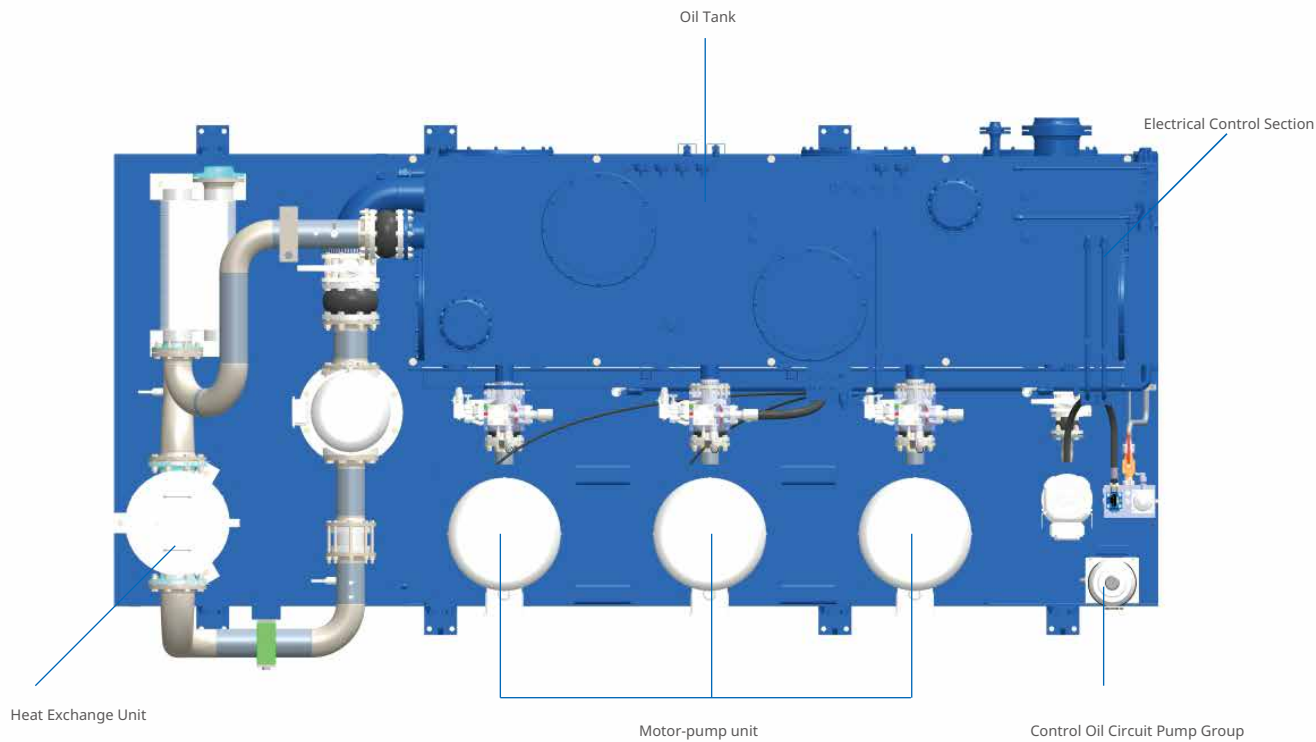
Schematics



Top View Display



Component Name



Technical Parameters

Technical Parameters (for application requirements beyond these parameters, please consult the company)

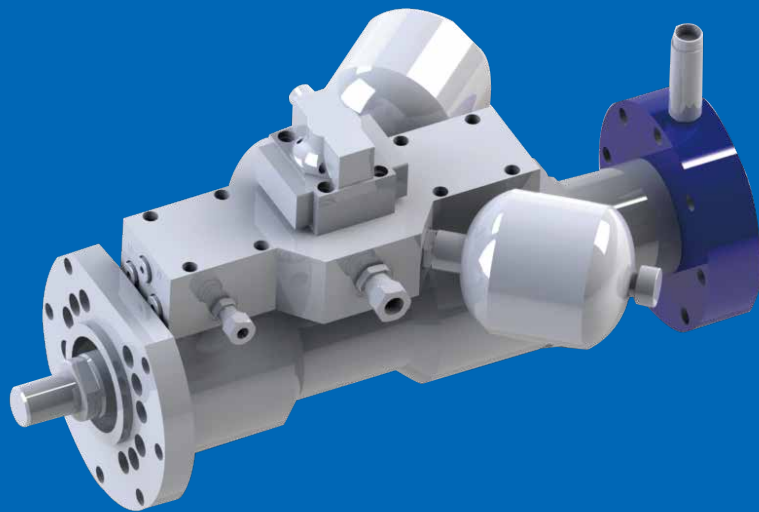
Hydraulic oil				Mineral oil HLP according to DIN 51 524 Part 2 For operating temperature of 50°C ISO VG46 DIN 51 519 (Other hydraulic oils as specified)
Pump model				High-pressure Piston Oil Pump A10VSO Series
Motor-pump unit				Three-phase Asynchronous Motor + High-pressure Variable Piston Oil Pump
Filtration/Cooling circulation module				Two-stage filtration: 5μ + 10μ; water-cooled heat exchange module
Operating pressure (absolute value)	Inlet	Pmin-max	bar	0.8 to 30
	Outlet	Pmax	bar	280
	Drain port	Pmin-max	bar	2
Hydraulic oil temperature range		§	℃	-25 to 70℃
				When operating with mineral oil HLP according to DIN 51 524, the optimal operating temperature range for the hydraulic pump station is 40°C and 50°C. During continuous operation, the working temperature must not exceed 70°C.
Oil cleanliness class according to ISO standard				The maximum oil contamination level is according to ISO 4406 (C) and according to the requirements of the hydraulic system ¹⁾
Safety pressure				280
Viscosity range		v	mm ² /s	Optimal range is 16 to 36
		v	mm ² /s	Short-term from 10 to 1000
Motor model				AC permanent magnet servo motor
Voltage		u	v	380/440 [For other requirements, please consult the company]
Rotational speed		n	min ⁻¹	max1500
Protection rating				IP55
Direction of rotation				Counterclockwise (as viewed from the M drive shaft)
Oil filter	Air filter		μm	10
	Return oil filter		μm	10
Surface protection		High-pressure filter	5μm	Painted with epoxy resin paint according to RAL 5009 (RN 123.01)
Piping system model				Installed according to DIN 2353 light/heavy series models

¹⁾In a hydraulic system, the required cleanliness level of the components must be achieved; effective filtration prevents problems and also extends the service life of the components.

Servo Actuation Unit

Servo Cylinder

- Low Friction Seal Servo Cylinder
- Static Pressure Support/Gap Seal Servo Cylinder
- Swing Cylinder
- EHA Electro-Hydraulic Actuator



Low-Friction Seal Servo Cylinder

Standard Specifications:

- ANSI/(NFPA)T3.6.7R3-2009

Specifications and Installation Dimension Standards

- Square-head tie rod design. Standard pressure - 3000 PSI¹
- Standard hydraulic oil
- Standard temperature
- Piston rod diameter - 0.625" to 4.000" 10-1000 mm
- Mounting type - 19 standard types, suitable for different application grades
- Rod end - four standard options - special order

1. If the hydraulic working pressure exceeds 3000 psi, send application data for engineering evaluation and recommendation.

2. Please refer to the section for high-temperature applications.

Available mounting methods

Basic Style T (NFPA MX0)	Tie Rods Extended Head End Style TB (NFPA MX3)	Tie Rods Extended Cap End Style TC (NFPA MX2)	Tie Rods Extended Both Ends Style TD (NFPA MX1)
Head Rectangular Flange Style J (NFPA MF1)	Head Square Flange Style JB (NFPA MF5)	Head Rectangular Style JJ (NFPA ME5)	Cap Rectangular Flange Style H (NFPA MF2)
Cap Square Flange Style HB (NFPA MF6)	Cap Rectangular Style HH (NFPA ME6)	Side Lug Style C (NFPA MS2)	Side Tapped Style F (NFPA MS4)
Cap Fixed Clevis Style BB (NFPA MP1)	Head Trunnion Style D (NFPA MT1)	Cap Trunnion Style DB (NFPA MT2)	Intermediate Fixed Trunnion Style DD (NFPA MT4)
HD Intermediate Fixed Trunnion Style DE (NFPA MT4)	Spherical Bearing Style SB	HD Spherical Bearing Style SE	Double Rod Cylinders Style KT Shown

Model selection code FSC - CYW - 160

X
a- X
b- X
c- X
d- X
e- X
f- X
g- X
h- X
i- X
i- X
k

FSC-design series CYW—single-rod hydraulic cylinder with position sensor = CDW

a Installation method (piston diameter, piston rod diameter)

1=40/28

2=50/36

3=63/45

4=80/36

5=80/56

6=100/45

7=100/70

8=125/56

9=125/90

10=160/70

11=160/110

12=200/90

13=200/140

b Stroke length

XXXX

c Ports / Mounting plate

Oil port BSP thread according to ISO228/1 (oil port size corresponds to piston diameter)

d Valve fixed wrench (the valve spool rotated 90° relative to the cylinder axis)

1 = size 6

2 = size 10

3 = size 16 4 = size 25

e Valve fixed wrench (the valve spool rotated 90° relative to the cylinder axis, parallel)

1 = size 6

2 = size 10

3 = size 16

4 = size 25

f Piston rod type

1 = Piston rod surface quenched and hard chrome plated

2 = Hard chrome plated

g End cushioning

1 = No cushioning

2 = End cap side cushioning

3 = Cylinder head side cushioning

4 = Cushioning on both ends

h Hydraulic oil

1 = Seals suitable for DIN51524 (HL, HLP) mineral oil

2 = Fluororubber (FKM) seals suitable for phosphate ester (HFD-R)

i Seals

1 = For low-friction operation

2 = Piston: Glyd ring seal

3 = Piston rod: Glyd ring seal

j Extended part of the stop collar**k** Position sensor Magnetostrictive:

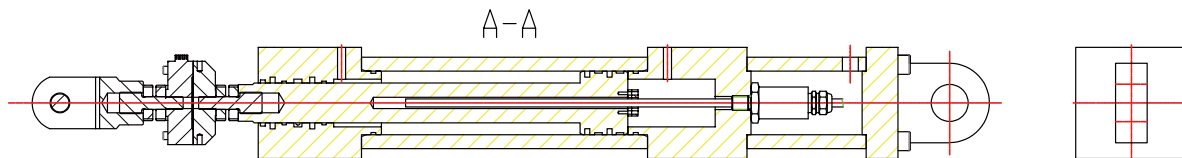
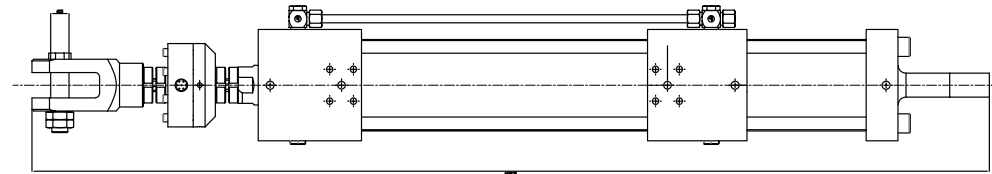
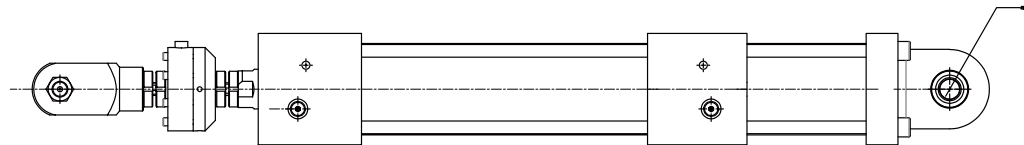
1 = Analog output 4–20 mA

2 = Analog output 0–10 V

3 = Digital output SSI interface

4 = No position sensor, but reserved end position

Position sensor type 7.1.-...

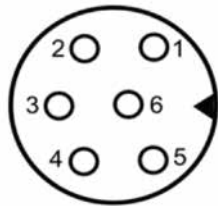


1) Included in the supply

2) Socket connection clearance requirement

Position sensor type 7.1.- ..., (analog output)

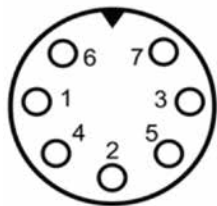
Socket components or cable connector (pin face view)



Pin	Cable	Signal/Current	Signal/Voltage
1	Grey	4...20mA	0-10V
2	Pink	Gnd	Gnd
3	Yellow	n.c.	10-0V
4	Green	n.c.	Gnd
5	Brown	+ 24V dc (±25%)	+24Vdc (±25%)
6	White	Gnd	Gnd

Position sensor type 7.1.- ..., (SSI output)

Socket components or cable connector (pin face view)



Pin	Cable	Signal/SSI
1	Grey	Data (-)/Data (-)
2	Pink	Data (+)/Data (+)
3	Yellow	Pulse (+)/Clock (+)
4	Green	Pulse (-)/Clock (-)
5	Brown	+ 24V DC (+20% / -15%)
6	White	0V
7	-	n.c.

Hydrostatic bearing/gap-sealed servo cylinder

Features

- High-frequency dynamic response
- Capable of continuous high-speed operation under high lateral load
- Minimal friction and stick-slip
- Extremely high reliability, fatigue-resistant
- Very long service life
- Compact structure, responsive, stable at high speeds
- High repeat positioning accuracy
- Leakage oil can be discharged without relying on an auxiliary oil pump
- Frequency ≤400 Hz, with a maximum linear speed of up to 10 m/s;
- The piston diameter can be freely increased or decreased in 1 mm increments;
- Fewer components and a cylinder barrel manufactured as a single piece from high-strength solid alloy round stock give the actuator exceptional reliability and versatility, with a load range from 2 kN to 6500 kN;
- Seals with fluid hydrostatic bearing technology not only greatly reduce friction and ensure heat dissipation, but also withstand exceptionally high radial offset deviations; this design can prevent rapid wear and damage;
- This series of actuators uses an integrated double piston rod. The one-piece piston rod is machined from heat-treated alloy steel, with a specially treated, ground, and polished surface;
- This series of actuators uses a reinforced composite metal coating on the piston surface, greatly reducing wear and static friction;
- Built-in displacement sensor based on the linear variable differential transformer (LVDT) principle;
- Servo actuators of special models can be customized according to customer requirements;



Product features:



High frequency



High precision



Low friction



Long service life



High output force



Customizable



High cost-performance ratio

Selection code:

4 - Intermediate Articulation

SFG- Xa - Xb - Xc - Xd - Xe - Xf - Xg - Xh					
a Structure	d Cylinder bore/rod diameter (mm)	f Lateral force			
SFG—double-rod hydrostatic-bearing servo actuator	Example: 080/050	1-16%~20%			
b Stroke (mm)	e Displacement Sensors	2-30%~40%			
0050: effective stroke of 50 mm	1 - LVDT displacement sensor	g Valve block			
c Pressure	2 - Magnetostrictive displacement sensor	0 - No valve block			
1=21 - Rated pressure 21 MPa	3 - Accelerometer	1 - Custom valve block/servo valve/accumulator			
2=28 - Rated pressure 28 MPa		h Connection type			
		1 - Front-end flange connection 2 - Rear flange connection			
		3 - Spherical joint connection at both ends			
		4 - Intermediate Articulation			

Example: SFG-0050-1-080/050-2-2-0-1

SFG - double-rod hydrostatic bearing servo actuator - effective stroke 50 mm - rated pressure 21 MPa - 080/050 - magnetostrictive displacement sensor - 30%~40% - without valve block - front-end flange connection

Parameter Table Type Selection Parameter Table

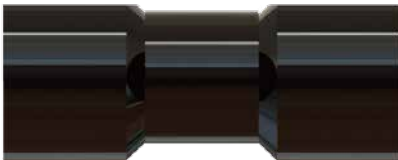
Tonnage (kn)	Rod diameter (mm)	Cylinder diameter (mm)		Bearing lateral force (KN)	
		21Mpa	28Mpa	16%~20%	30%~40%
10	45	52	50	✓	×
16	63	71	69	✓	✓
25	63	75	72	✓	✓
50	80	98	94	✓	✓
63	80	102	94	✓	✓
100	100	127	121	✓	✓
160	125	160	152	✓	✓
250	160	205	195	✓	✓
500	200	270	255	✓	✓
630	200	280	265	✓	✓
1000	250	355	330	✓	✓
1300	300	415	390	✓	✓
1600	330	455	432	✓	✓
2000	350	495	468	✓	✓
2500	380	550	512	✓	✓

Structure

- An integrated piston and piston rod with a fatigue rating provide equal tensile and compressive loads.



- The thick-walled cylinder, integrally manufactured from high-strength solid material, offers bending resistance and an increased transverse resonance frequency.



- The piston rod and piston surfaces are coated with an enhanced wear-resistant layer, greatly reducing wear and static friction. Internal and external threads on the piston rod allow mounting of vibration tables, tension-compression sensors, and fixtures, etc. The piston features an equal-pressure oil groove, eliminating the need for piston seals and thereby removing friction and internal resistance.

- An automatic self-centering hydrostatic bearing is used to withstand high lateral loads and reduce friction. Regardless of the magnitude of external shear forces, the actuator maximally ensures that the piston rod moves at the center of the cylinder, preventing unilateral wear.



- High-pressure seals and low-pressure seals/wiper rings ensure that leaked oil is discharged without relying on an auxiliary pump. The tight tolerance fit between the piston and the cylinder inner wall provides an effective viscous seal. Grooves on the piston ensure thorough lubrication of the piston surface. Each piston rod seal assembly includes a component that routes excess hydraulic oil back to the tank, as well as a wiper seal ring to prevent external contamination, effectively stopping contaminants from entering the actuator.



- The hydrostatic-supported servo actuator assembly is the device in an electro-hydraulic servo system that generates force and displacement; it is a key component for dynamic loading and is primarily used in dynamic/static and fatigue testing. The dynamic servo actuator assembly consists mainly of a hydrostatic-supported servo cylinder, a displacement sensor, and a servo valve, and can achieve multiple closed-loop control schemes.

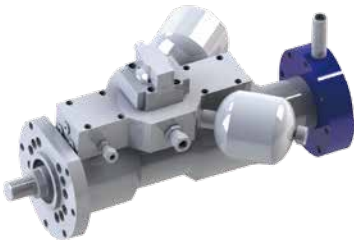
Installation Mode

Hydrostatic-supported servo actuator assemblies are typically installed vertically. The bottom of the actuator and the rod end can be connected via spherical joints or rotary joints, or the bottom of the actuator can be fixed with a high-stiffness flange. In some cases, the actuator is installed horizontally on a base.

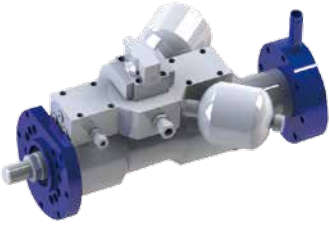
Cylinder mounting method



L1: Front-end flange mounting



L2: Rear-end flange mounting



L3: Front and rear-end flange mounting



L4: Single-eye ring mounting at the tail

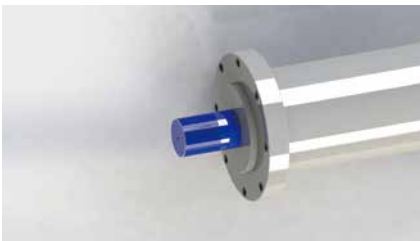


L5: Ball-joint mounting at the tail end



L6: Mid trunnion support mounting

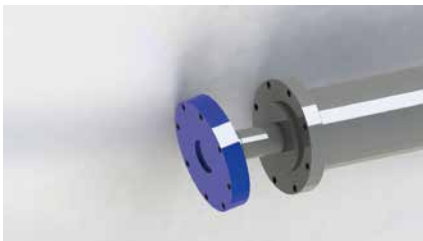
Rod-end connection method



V1: External thread connection at the rod end



V2: Single-eye ring connection at the rod end



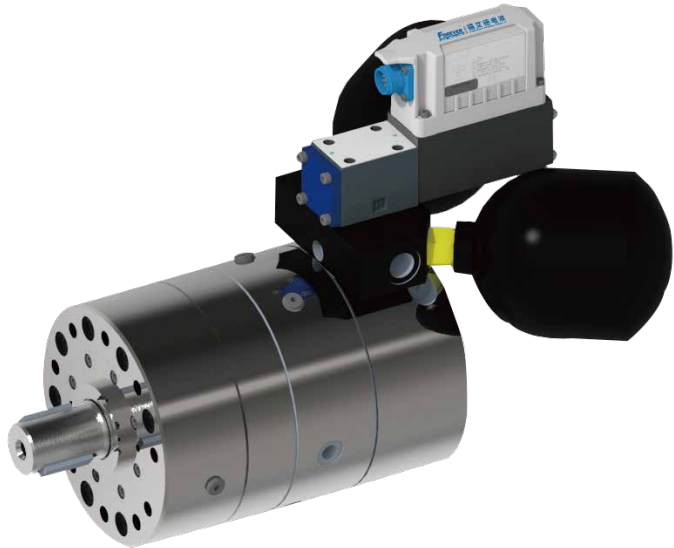
V3: Ball-joint connection at the rod end

Oscillating cylinder

Usage Instructions

The hydraulic servo rotary actuator (Oscillating cylinder) mainly consists of the front end cap, vane, re ar end cap, angle sensor, etc. The vane oscillating cylinder has no return backlash and no mechanical friction, making it very suitable for reciprocating high-frequency rotational motion. It also has no echanical wear and a low starting torque, with a service life of over 20 years.

Applications: torque loading, motion simulation, fatigue testing, servo turntables, robotics, automated production lines, etc



Product features:



High frequency



High precision



Low friction



Long service life



High torque



Customizable



High cost-performance ratio

Characteristic

- Adopts contact sealing technology, fluid dynamics technology, or hydrostatic bearing technology
- High dynamic response
- High rotational speed
- High positioning accuracy
- Low starting pressure
- Rugged and durable construction
- Ultra-long service life
- Non-standard customization available

Type Selection Parameter Table

Torque (NM)	Unit torque (N·m/bar)	Working pressure (MPa)	Torsion angle °	Standard performance	Bearing
300	1.4	21/28	±50	Frequency up to 100 Hz Speed: up to 1500°/s	Deep-groove ball bearing/hydrostatic bearing
600	2.9	21/28	±50	Frequency up to 100 Hz Speed: up to 1500°/s	Deep-groove ball bearing/hydrostatic bearing
1200	5.7	21/28	±50	Frequency up to 100 Hz Speed: up to 1500°/s	Deep-groove ball bearing/hydrostatic bearing
2200	10.5	21/28	±50	Frequency up to 100 Hz Speed: up to 1500°/s	Deep-groove ball bearing/hydrostatic bearing
4500	21.4	21/28	±50	Frequency up to 100 Hz Speed: up to 1500°/s	Deep-groove ball bearing/hydrostatic bearing
10000	47.6	21/28	±50	Frequency up to 100 Hz Speed: up to 1500°/s	Deep-groove ball bearing/hydrostatic bearing
14000	66.7	21/28	±50	Frequency up to 100 Hz Speed: up to 1500°/s	Deep-groove ball bearing/hydrostatic bearing
18000	85.7	21/28	±50	Frequency up to 100 Hz Speed: up to 1500°/s	Deep-groove ball bearing/hydrostatic bearing
36000	171.4	21/28	±50	Frequency up to 100 Hz Speed: up to 1500°/s	Deep-groove ball bearing/hydrostatic bearing

Model selection code										FSS-		X	-	X	X	X	X	-	X	-	X	-	X																										
												a		b	c	d	e		f		g		h																										
a										Structure										c										Pressure (MPa)																			
										1 = FSS - Double-vane rotary cylinder																				1 = 21 - Rated pressure 21 MPa 2 = 28 - Rated pressure 28 MPa																			
b										Torque (kN) @ 210 bar										d										Swing angle (°)																			
										Example: 0500 - Maximum output torque 500 Nm at static conditions																				050: Swing angle ±50°																			
										1=300 2=600 3=1200 4 = 2200 5 = 4500																				h										Connection type									
										6 = 10000 7 = 14000 8 = 18000 9 = 36000																				1 = Parallel key drive 2 = Spline drive																			
e										Angle sensor																																							
										1 = SSI angle sensor 2 = Analog angle sensor																																							
f										Lateral force																																							
										1=16%~20% 2=30%~40%																																							
g										Valve block																																							
										1 = No valve block2 = Custom valve block/servo valve/accumulator																																							

EHA-Servo Motor Pump Unit



Advantages:

- Energy savings up to 70%
- Noise reduction up to 20 dB(A)
- Reversible operation
- Preconfigured motor-pump drive
- Drive unit for independent axes

DrivAxThe servo drive combines the advantages of hydraulics and servo drives, resulting in high energy efficiency, low heat and noise emissions, and at the same time high robustness, power density and dynamic performance.

DrivAx servo drives consist of a variable-speed pump and a servo motor, with the servo motor serving as both the drive and the actuator control. They are suitable for all linear motions that require high force and precision, while delivering high productivity and protecting the environment, climate, and resources.

DrivAx servo drives offer various system configurations: motor-pump combinations, standalone drives, application-specific system solutions. Easy to integrate, quick to commission.

DrivAx drives are compact and optionally available as standalone systems, making them very easy to integrate into machines. Only mechanical interfaces, electrical connections, and data connections to the sensor system are required. Since complex power unit piping, valve technology wiring, and hydraulic fluid filtration are not needed, you can save a great deal of time in machine design and commissioning, achieving lean mechanical engineering without any compromise.

Product features:



Low energy consumption



Low noise



Compactness



High accuracy



Digital control



Optional modules



Bus control



Low temperature rise

Selection code:

FESP-

X

-

X

-

X

-

X

-

X

a

Variable mode

d

Loading time (s)

1 - Fixed displacement: 5/8/13/202 - Variable displacement: 19/32/80/140/250

Example: 015 = 15 s

b

Large displacement/Small displacement

e

Control method (bus)

Example: 32/05 (large displacement 32 CC, small displacement 05 CC)

1: Analog

c

Pressure

2:EtherCAT

Example: 0210 = 210 bar

3:Pro Inet

Example: FESP-2-32/05-0210-015-1

FESP - variable pump - large displacement 32 CC, small displacement 05 CC - 210 bar - loading time 15 s - control method Analog

Type Selection Parameter Table

IQ4 pump displacement

IQ4 pump displacement	5 cc/rev	8 cc/rev	13 cc/rev	20 cc/rev
Maximum flow (480V)	24L/min	38L/min	57L/min	83L/min
Maximum flow (380V)	18L/min	29L/min	43L/min	63L/min
Port A Port B Maximum operating pressure (1500 rpm)	345bar	345bar	345bar	345bar
Port A Port B Maximum operating pressure (maximum speed)	230bar	230bar	230bar	230bar
Maximum case pressure	11bar	11bar	11bar	11bar
Pump operating conditions	Internal gear pump, four-quadrant pump			
Cooling method	Water cooling or air cooling			
Operating temperature	Ambient: -20 to +60°C Coil temperature: -20 to +80°C			
Seal material	FKM			
Medium	Mineral hydraulic oil			
Viscosity	10...100 mm²/s (cSt), uo to nmax 10...300 100 mm²/s (CST) to n=1800 rpm			
System filtration	NAS 1638, Class 9 ISO 4406, Class 19/17/14			
Installation orientation	Any			

Type Selection Parameter

RQ4 pump displacement	19cc/r	32cc/r	80cc/r	140cc/r	250cc/r
Maximum flow (480V)	85L/min	118L/min	216L/min	322L/min	450L/min
Maximum flow (380V)	65L/min	90L/min	166L/min	247L/min	340L/min
Port A Port B Maximum operating pressure (1500 rpm)	350bar	350bar	350bar	350bar	350bar
Maximum case pressure	10bar	10bar	10bar	10bar	10bar
Pump operating conditions	Radial piston pump, fixed or variable displacement				
Cooling method	Water cooling or air cooling				
Operating temperature	Environment: -15 to +60 °C Oil temperature: -15 to +80 °C				
Seal material	FKM				
Control mode	External control				
Medium	Mineral hydraulic oil DIN 51524, HFD,				
Viscosity	Optimal viscosity range 12 to 100 mm2/s (12 to 100 cSt) Recommended medium VG 46 to VG 100 - ISO 3448; maximum viscosity 500 mm2/s starting speed 1 800 r/min				
System filtration	NAS 1638, Class 9 ISO 4406, Class 20/18/15				
Installation orientation	Any				

EHA - Electro-Hydraulic Actuator Cylinder

Working principle



Product features:

Low energy consumption

Low noise

Compactness

High accuracy

Digital control

Optional modules

Bus control

Low temperature rise

EHA compared with traditional hydraulic systems and electromechanical cylinder systems

Category	Traditional hydraulic system	Electric cylinder system	EHA system
Degree of compactness	Complex	Simple	Simple
Power consumption	Very large	Small	Small
Cooling power	Very large	Small	Small
Cylinder output force magnitude	Large	Small	Large
Mechanical clearance or wear	None	Have	None
Environmental pollution/Noise	Large	Small	Small
Frequency	High	Low	Low
Cost	High	Small	Small

Product Features

Low energy consumption

This device operates according to the conditions required by the actual process (flow, pressure), with no excess power loss, achieving energy savings.

Low noise

In pressure control mode, because the pump's rotational speed only compensates for internal leakage in the hydraulic system, noise is almost nonexistent; in flow control mode, because the rotational speed matches the machine's demand, it can achieve lower noise than existing equipment.

Compactness

The servo motor, bidirectional hydraulic pump, control valve assembly, sealed enclosure, and accessories are compactly integrated to save footprint. The servo cylinder assembly also integrates displacement/force sensors.

High accuracy

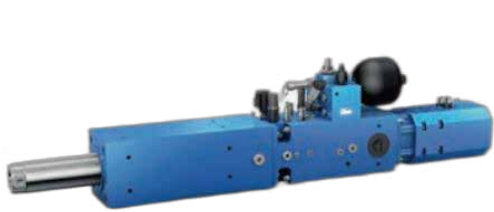
Position control accuracy: ±0.005 mm
Pressure control accuracy: < ±0.5% FS.

Digital control

The dedicated controller serves as the control software, incorporating dual-loop position-pressure control and switching. It is configured with general protocol ports, making it easy to connect with popular PLCs, PCs, and HMIs to form a system. Control parameters are digitally set, ensuring safety and ease of operation.

Optional modules

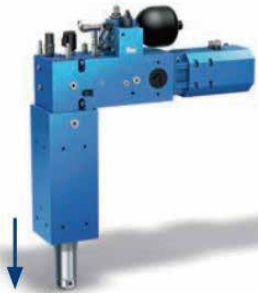
According to the machine's actual process, there may be "forward load" and "reverse load." Different "balancing modules" can be optionally configured to achieve smooth operation and control under different loads.



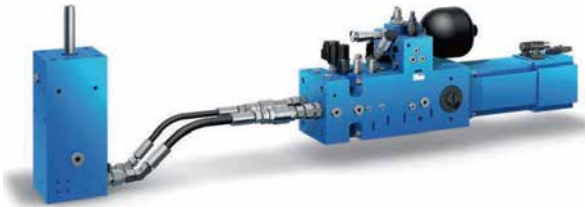
Straight-out type



Parallel type



Vertical type



Free type

Model selection code		FEHA	-	X	-	X	-	X	-	X	-	X
		a		b		c		d		e		f
a	Product Types	FEHA Electro-hydraulic Actuator										
d	Operating speed	Example: 1A is 200 mm/s no-load, 60 mm/s under load										
b	Tonnage	(refer to the table on the right)										
e	Connection type	1=Front-end flange connection										
		2=Rear flange connection										
		3=Ball joint connection at both ends										
		4=Middle articulation										
f	Control mode	1: Analog										
c	Stroke (mm)	2:EtherCAT										
		3:Profinet										

Type Selection Parameter Table

Output (T)	Serial Number	No-load speed (mm/s)	Loaded speed (mm/s)	Power (kW)	Cooling power (kW)
10T	1A	200	60	11	2.9
	1B	320	95	15	4
	1C	500	150	25	5.2
	1D	710	210	31	7
20T	2A	100	30	11	2.9
	2B	160	45	15	4
	2C	250	75	25	5.2
	2D	355	105	31	7
30T	3A	65	20	11	2.9
	3B	105	30	15	4
	3C	165	50	25	5.2
	3D	235	70	31	7
50T	4A	40	10	11	2.9
	4B	60	15	15	4
	4C	100	30	25	5.2
	4D	140	40	31	7
80T	5A	25	8	11	2.9
	5B	40	10	15	4
	5C	60	15	25	5.2
	5D	85	20	31	7
100T	6A	20	6	11	2.9
	6B	30	10	15	4
	6C	50	15	25	5.2
	6D	70	20	31	7

Hydraulic Servo Controller

- Rmc70 Series 1-2 Axis Motion Controller
- Rmc200 Series 1-50 Axis High-performance Motion Controllers



Δ RMC70

RMC70 series Uniaxial and biaxial motion controller



The RMC70 base module includes a CPU module, communication interfaces, and single-axis or dual-axis control. Up to 4 expansion modules can be added (for example, analog inputs and digital I/O modules).

The RMC70 series motion controller is a high-performance yet easy-to-use, cost-effective single-axis or dual-axis system.

Exceptional control performance—including dual-loop position-pressure control algorithms and multiple actual-value feedback types—makes the RMC70 the optimal solution for hydraulic, electric, and pneumatic positioning and dual-loop position-pressure control.

Communication with commonly used PLCs and HMIs is very easy because it supports many different protocols, has simple address definitions, and allows PLC addresses to be mirrored. Motion programs with strict response-time requirements can be handled in the RMC70 via flexible user programs, thereby reducing PLC computational load.

By using a rich set of motion parameters, including acceleration, velocity feed forward, and control gains for different motion directions, equipment can run smoother and more accurately, thereby increasing productivity, improving quality, and extending equipment life.

A command-based programming model speeds up program development and reduces maintenance workload. Advanced oscilloscope and diagnostics functions can be used to diagnose the entire motion control system.

RMCTools software and its very detailed help resources can be downloaded from www.deltamotion.com.

The RMC70 series controller is a product carefully developed and manufactured based on 30 years of accumulated experience. Our 24/7 service commitment means you can call us at any time, and we will help solve your problems.

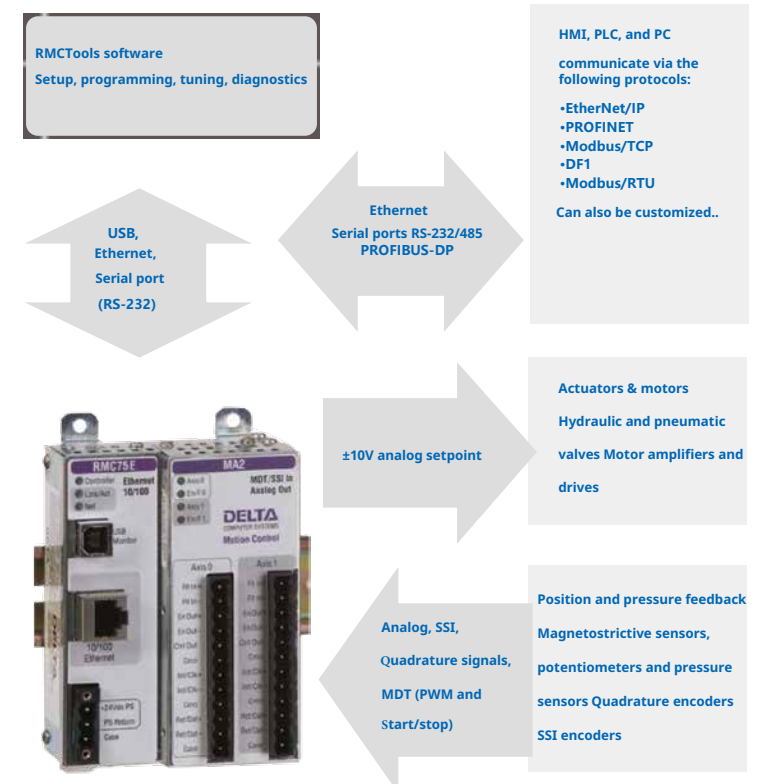
Features

Setup and programming

- ▲ Command-based mode — minimal program development and maintenance workload
- ▲ Flexible user programs — advanced motion programs that can include user-defined variables and mathematical formulas
- ▲ Highly detailed, word-association-based on-line help

Control algorithms

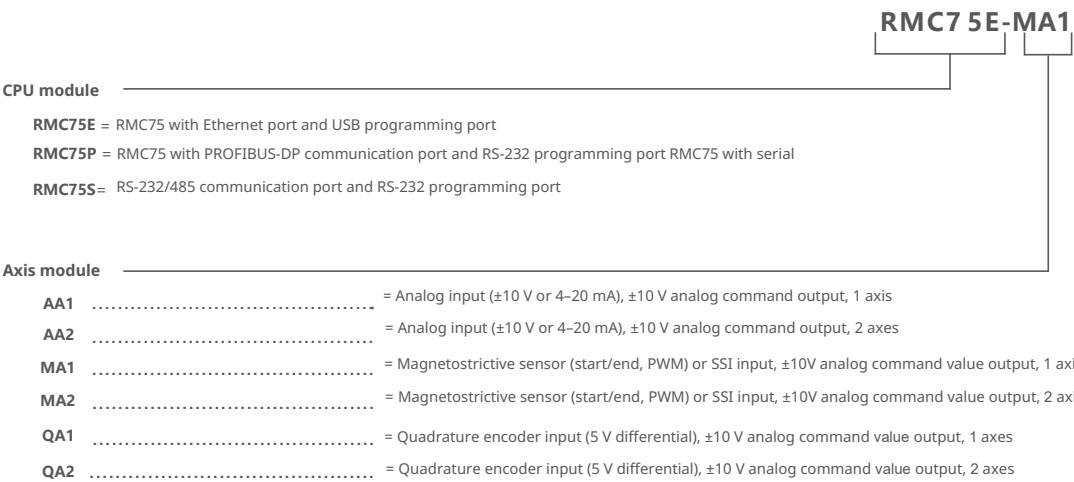
- ▲ Position, speed, pressure, force, position-pressure, position-force, speed-pressure, speed-force, active filtering
- ▲ Full-featured parameter settings to achieve high-performance motion tuning and diagnostics
- ▲ Exceptional graphical display capabilities during motion optimization
- ▲ Event logging can record controller actions in real time



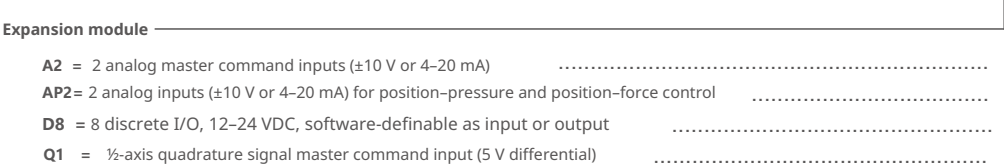
ARMC70

RMC 70 series order codes

RMC70 base module



RMC70 expansion module



Accessories or others

Installation dimensions
Voltage-current converter



VC2124

Cable assembly
Terminal module
Inputs and outputs can be paralleled,
output current up to ±200 mA

Order number example

RMC75E-MA2
CPU with Ethernet communication; 2-axis magnetostrictive sensors (Start/Stop or PWM) or SSI sensor feedback.
RMC75P-QA1
CPU with PROFIBUS communication; 1-axis quadrature encoder feedback.
EXP70-D8
8-channel discrete I/O.

ARMC200

Axis Motion Controller



The RMC200 is DELTA's latest high-performance motion control platform, suitable for industrial applications with up to 50 axes in the S Series and up to 18 axes in the L Series for hydraulic, electric servo, and pneumatic systems. Use r-swappable modules provide flexibility and connectivity for various sensor types.

The RMC200 CPU module comes standard with Ethernet and supports protocols such as EtherNet/IP, PROFINET, and Modbus/TCP. This design enables it to connect with the most commonly used PLCs, PCs, and HMIs to form a system.

DELTA's RMCTools software handles setup, programming, tuning, and diagnostics for the RMC200, RMC150, and RMC75 controllers. It features powerful graphics and easy-to-use wizard functions.

Flexible multi-axis functionality

As DELTA's largest and most powerful motion controller, modules can be "mix-and-match" to support tightly synchronized motion of up to 50 axes.



Application Industries

- Wood processing
- Test equipment
- Metal processing
- Energy / Oil and Gas
- Automotive industry
- Aerospace
- Plastics and rubber
- Entertainment industry equipment
- Mining

For more applications, please refer to:
deltadmotion.com/applications

Communication

▲ Ethernet (10/100 Mbps), built-in dual-ported CPU (single IP address), supports star and linear topology

- EtherNet/IP
- Modbus/TCP
- CSP (Allen-Bradley)
- FINS (Omron)
- Profinet
- USB interface

▲ Used for RMCTools software debugging as well as RMCLink ActiveX and .Net programs



Types of position feedback

- Synchronous Serial Interface (SSI)
- Linear and single-turn or multi-turn rotary axes
- Magnetostrictive Linear Displacement Sensors (MDT)
- RS-422 Start/Stop and PWM signals
- Analog signal interface ±10V and 4-20mA
- Orthogonal TTL encoder

ARMC200

Ordering information

A complete motion controller requires a base, a power supply, a CPU with a control-loop function key, and I/O modules.

Base

Lite

R200-B5 L5 empty-slot base (3 of which are for I/O modules).....	p.47*
R200-B7 L7 empty-slot base (5 of which are for I/O modules).....	p.47

Standard

R200-B5 5 empty-slot base (3 of which are for I/O modules).....	p.47
R200-B7 7 empty-slot base (5 of which are for I/O modules).....	p.47
R200-B11 11 empty-slot base (9 of which are for I/O modules).....	p.47
R200-B15 15 empty-slot base (13 of which are for I/O modules).....	p.47

Power supply

Lite

n/a No power module required. The power supply is integrated in the CPU.

Standard

R200-PS4D 24 Vdc input, 35 W output power supply for B5, B7, and B11 bases.....	p.50
R200-PS6D 24 Vdc input, 50 W output power supply for B15 base	p.50

C P U

Lite

200-CPU20L RMC200 CPU module controls up to 18 master axes, dual Ethernet ports, USB, SD card slot, display, 2 discrete inputs, 2 discrete outputs.....	p.51
---	------

Standard

R200-CPU40 RMC200 CPU module controls up to 50 master axes, dual Ethernet ports, USB, SD card slot, display, 2 discrete inputs, 2 discrete outputs.....	p.51
---	------



EtherCAT module, R200-ECAT module support EtherCAT master protocol

Function key

R2-KLnnn Removable function key installed in the CPU module. Specify the number of control loops when ordering, at least 4 loops	p.54
--	------

Input/Output Modules

R200-A8	8- channel analog input: ±10V or 4–20mA.....	p.55
R200-S8	8-channel SSI or MDT input, supports one quadrature input: Synchronous Serial Interface (SSI) with start/stop or PWM signal or magnetostrictive displacement sensor (MDT), supports one quadrature input	
R200-ECAT	EAT: with EtherCAT master module.....	p.57
R200-Q4	4- channel quadrature encoder input: RS-422, HTL, or TTL, with reference input and latch input.....	p.59
R200-LC8	Load cell input module LC8.....	p.62
R200-CA4	4- channel analog output: ±10V, 4–20mA, or ±20 mA, with fault input and enable output functions.....	p.64
R200-CV8	8- channel analog output: ±10V with independently configurable discrete I/O.....	p.66
R200-D24	24-channel discrete signal I/O: 20 configurable I/O, 4 fixed high-speed inputs, including 2 quadrature encoder inputs or 2 pulse counter inputs.....	p.68
U14 I/O Module	Multifunction module: 4 analog inputs, 2 analog outputs, 4 discrete I/O points, 2-channel SSI, MDT, or quadrature encoder input with high-speed discrete inputs.....	p.71

Options

R2-SC Empty Slot Cover: Empty I/O slot cover.....	p.77
---	------

Accessories

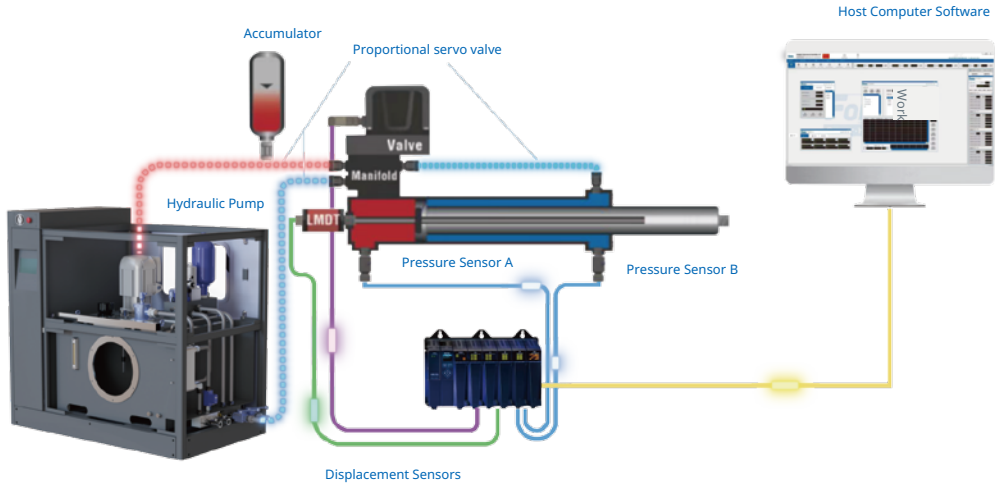
SD card.....	p.77
Connecting cable.....	p.77
Voltage-current converter.....	p.78
Terminal port.....	p.78

*Note: Please refer to the page numbers in the Hydraulic Servo Control Manual for model selection

Hydraulic Servo Design Guide

Correct and incorrect practices in hydraulic position control system design

Hydraulic drive systems can achieve high-performance hydraulic positioning control. A precisely designed closed-loop hydraulic actuator can position heavy loads with accuracy better than 0.01 mm. Fast and precise positioning requires selecting a controller designed for hydraulic actuation, such as the easy-to-master RMC series controllers. In addition, proper hydraulic system design is equally important. This article briefly lists the correct and incorrect in designing high-performance closed-loop hydraulic control systems.



Proper designs:

- ▶ **Valve with servo characteristics**
Use a servo valve or a proportional servo valve with zero overlap; the control input command has a linear relationship with the flow output.
Comparison: Error 2
- ▶ **Mount the valve on the cylinder**
Install the valve at the end or on the top of the cylinder. This will minimize the amount of oil accumulated in the oil passage between the valve and the cylinder piston.
Comparison Error 1
- ▶ **Use an accumulator**
Use an accumulator and install it as close to the servovalve as possible. The accumulator volume should be more than ten times the hydraulic oil volume change.
- ▶ **Pre-charge accumulator**
Pre-charge the accumulator to 80% of the system pressure. Oil in the accumulator that cannot be effectively used will reduce the accumulator's effectiveness. The nitrogen bladder should be as large as possible, and there should also be sufficient hydraulic oil in the accumulator.
- ▶ **Select a hydraulic pump with an appropriate flow rate**
The flow rate of the hydraulic power pump should be the average flow required by the system plus a 10% margin. After using an accumulator, it is no longer necessary to size the pump based on the system's peak flow rate.
- ▶ **Select the correct hydraulic piping**
Use piping with sufficient pressure rating, and minimize the number of 45-degree or 90-degree elbow fittings in the return line as much as possible.
- ▶ **Select a valve with an appropriate flow rate**
A servovalve with sufficient flow must be selected to ensure the system can accelerate at the specified acceleration and reach maximum speed. Please note that under high-flow conditions the pressure drop across the valve increases, reducing the pressure differential between the two chambers of the cylinder and thereby affecting the system's acceleration capability.

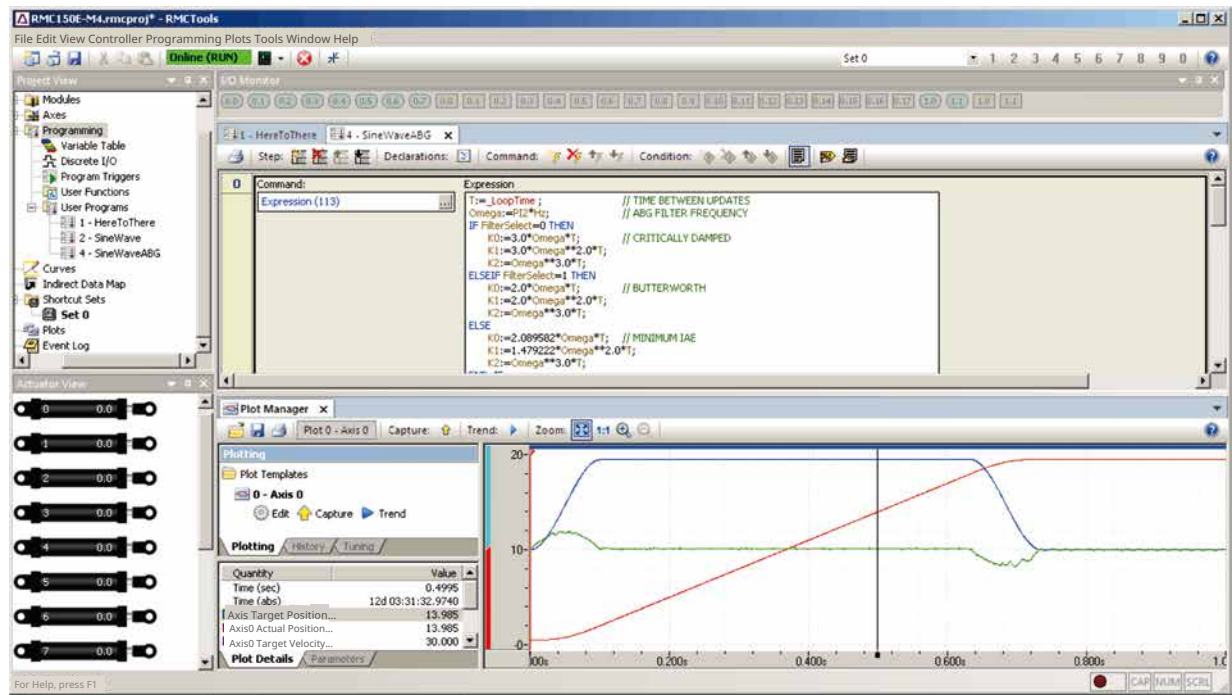
- ▶ **Choose the appropriate motion controller**
Many of the parameters, sensor signals, and algorithms required for hydraulic closed-loop control cannot be found in ordinary servo motor motion controllers. DELTA's RMC motion controller integrates these functions, so in addition to being suitable for motor control and pneumatic control, it can also perform high-performance closed-loop control of hydraulic circuits.
- ▶ **Select a precision position feedback sensor**
Install a magnetostrictive linear displacement sensor (MDT or LDT) inside the hydraulic cylinder. Cylinders with built-in MDT magnetostrictive scales are available on the market.
MDT magnetostrictive scales can output start/end signals, PWM, SSI, or analog signals. (Sensors with analog outputs are not suitable for high-performance motion control because their signals are susceptible to interference, which will greatly reduce system resolution.)

Incorrect items:

- ▶ **Use flexible piping between the servo valve and the cylinder**
The piping between the servo valve and the cylinder must not use flexible hose. This is very important. Flexible hose makes system optimization very difficult and also reduces the effectiveness of closed-loop control. Contrast with Correct Item 2
- ▶ **Servo valve with covered spool**
Do not use a servo valve with a covered spool. This is also important. Contrast with the correct practice 1. When a covered spool slides from one end to the other during reversal, the system pauses and makes a banging sound. This makes system optimization difficult. Performance near zero speed deteriorates. Only a zero-coverage (uncovered) servo valve can achieve smooth switching during system reversal.
- ▶ **Servo valve amplifier and valve purchased separately**
Avoid choosing a separate servo valve amplifier whenever possible, because you will first need to optimize the servo valve amplifier. Many valves can integrate the amplifier onto the valve body; such amplifiers are already factory-tuned together with the valve to an optimal state and can be used directly.
- ▶ **Route different signal lines in a single cable tray**
Do not route the high-current pulse-width modulation signal lines from the servo valve amplifier to the servo valve together with the position feedback signal lines. This will introduce interference into the feedback signals.
- ▶ **Retaining open-loop control in closed-loop control design**
Some engineers worry about the effectiveness of closed-loop control and will place two different valves in the hydraulic circuit—one for open-loop control and one for closed-loop control—and switch between them via piping. This complicates the system, requiring more installation piping, making control programming and maintenance difficult. In fact, using DELTA controllers for closed-loop control is straightforward. The DELTA U.S. website offers online training courses, through which you can gain a deeper understanding of hydraulic closed-loop motion controllers.
- ▶ **Counterbalance valve**
Do not use a counterbalance valve. It will conflict with the closed-loop motion controller. If you need to lock a vertical load to prevent it from slipping, install a shut-off valve between the cylinder and the servo valve. Close this valve to stop the load from moving. Open it when closed-loop control is required.

Principle of Hydraulic Position Control Systems

To achieve better control, neither controllers nor software can overcome a poorly designed hydraulic system. A complete hydraulic servo control system includes a hydraulic motion controller, high-precision displacement, pressure, and load sensors, servo cylinders, high-precision hydraulic servo valves, a hydraulic power unit, piping, and other accessories. How do we select a more suitable hydraulic servo control?



Global competition requires our plant operators to face the never-ending task of making equipment run more efficiently. This often demands that our motion control systems be faster and more accurate. However, in a closed-loop control system, higher speed and accuracy must begin with good component design. No matter how much attention you pay to the controller and software, if the cylinder and valve in the fluid control system are not well designed, selected, or correctly installed, the system's performance will be greatly compromised.

Cylinder design and selection

The first step discussed above is to calculate the cylinder specifications, which ensures the system has good dynamic response and meets acceleration and deceleration requirements. This usually also means calculating the pressure required by the system.

The next step is to determine the valve specifications (rated flow). After completing the cylinder sizing, this follows directly. Note: The rated flow of servo valves and servo proportional valves is typically based on a pressure drop $\Delta P = 70$ bar (1,015 psi), whereas other proportional valves are usually based on a pressure drop $\Delta P = 10$ bar (145 psi). This is a significant difference. The flow at a 1000 psi pressure drop is approximately 2.65 times that at a 150 psi pressure drop. However, selecting the right valve is not merely a matter of rated flow, because most valves also have many functional options to consider. (Data source: Wuxi Forever Laboratory)

Which type of valve should be selected?

A proportional valve requires an amplifier to convert the motion controller's output voltage into a high current signal to drive the spool. For servo proportional valves, the amplifier compares the control signal or reference signal with the spool position signal fed back by the LVDT and generates an error. Some amplifiers use simple proportional control, while others adopt PI or PID control. If the amplifier is not well matched to the valve, the valve's performance will be compromised. The best approach is to choose proportional valves with integrated electronics, which helps ensure good amplifier matching. Procuring a separate amplifier card requires extra effort and expertise to adjust amplifier gain so that the spool can respond quickly relative to the control signal.

Another fact is that not all valve manufacturers test Bode plots under the same conditions. Different manufacturers define their ratings at different spool displacements. Compared with a 5% control signal, a 100% control signal usually yields very different spool travel response. This means that two valves both defined as 30 Hz—assuming one valve's rating uses a 5% control signal and the other uses a 50% control signal—are actually different. Many Bode plots show frequency response using 5% or 25% sinusoidal signals. A 5% rating is very suitable for applications with approximately 0% valve dither, such as pressure and force control systems. However, they are not suitable for high-speed applications, where the valve's working travel will reach 100%. A good rule of thumb is to take the 0–100% rise time, multiply by 4, and then divide by 1 to obtain the full-stroke frequency.

High-frequency-response linear valves are essential for high-performance position/pressure control systems. Of course, valve performance alone is not sufficient; you also need a good motion controller to compensate for the valve's response as well as the spring-mass effects of the actuator and load. To maximize the performance of a well-designed hydraulic system, it is also necessary to select an appropriate motion controller. They should have features such as independent rise and fall gain adjustment, position–pressure/force control, and the ability to connect directly to magnetostrictive displacement sensors.

Spool selection

For position and pressure/force control, select servo-proportional valves. As long as the pressure drop across the valve remains constant, the spool provides a flow that is proportional to the control signal. These valves have stable gain because their response is linear.

Positive overlap spool

On some valves, flow gain changes with the control signal. These valves typically have low flow gain when the control signal is near zero and high flow gain when the control signal is close to $\pm 100\%$. Valves with notches or dual-gain characteristics have distinct low-gain and high-gain regions, whereas nonlinear valves exhibit continuously varying gain. For manually operated systems, both types of valves can provide precise adjustment whether the operating flow is in the low-speed or high-speed range.



Dual-gain or variable-gain spool

For manual or open-loop control, this is not an issue; however, nonlinear valves make the entire system nonlinear and closed-loop control more difficult. When the valve switches between high-gain and low-gain regions, the controller must be able to change gain quickly. In theory, valve linearization (compensating variable gain as a function of the control signal) can be tuned using a motion controller. However, this requires matching the specific characteristics of the valve, thereby limiting its applicability. For a given change in flow within the low-gain region, the spool must move more, which reduces response in that region and degrades system performance.

Valves with open-notch spools work very well in closed-loop control only at low speeds. Open-loop or manual control can be used in the high-speed range, where the valve operates in the high-gain region. In this way, when the valve switches between the high- and low-gain regions, there is no need to change the closed-loop controller's gain rapidly. However, for most position and pressure control applications, it is best to avoid using notched or nonlinear valves.

Bigger might be better?

Manufacturers in the metal manufacturing industry are facing a problem: the servo system has not achieved the designed performance requirements. Hydraulic simulation indicates that the cylinder has not provided enough force to control larger loads, and the mathematical model recommends using a larger-sized cylinder and installing appropriately larger hydraulic valves.

Graphical analysis also shows how small cylinders fail to provide sufficient force to decelerate large loads more quickly. Smaller cylinders vent oil at the cylinder end cap (pressure drops to zero), while the pressure in the rod-end chamber exceeds the system pressure. The system becomes uncontrollable because the fluid at the rod end flows back to the supply unit, effectively reducing deceleration.

Large cylinders can accelerate the load at the same rate, but their larger piston area means the pressure does not change as much. Throughout the cycle, cylinder pressure generally stays near the middle of the pressure range, and to ensure good control, the pressure loss across the piston is substantial. Increasing cylinder diameter raises the system's natural frequency (stiffness), allowing the motion controller to handle faster acceleration and deceleration. When properly tuned, this improves system performance. However, bear in mind that larger cylinders require larger valves and more oil. Oversized cylinders are more costly, and larger valves respond more slowly; in some cases, increasing valve size does not improve system responsiveness.

Select the appropriate motion controller

Many of the parameters, sensor signals, and algorithms required for hydraulic closed-loop control are not found in conventional servo motor motion controllers. DELTA's RMC motion controller integrates these functions, so in addition to being suitable for motor control and pneumatic control, it can also perform high-performance closed-loop control of hydraulic circuits.

Use an accumulator

The flow rate of the hydraulic power unit pump should equal the system's average required flow plus a 10% margin. Once an accumulator is used, there is no need to size the pump based on the system's peak flow.

Select the correct hydraulic piping

The hydraulic servo power source can only be used for control after multiple flushes; otherwise, contaminants in the fluid may cause valve damage and blockage.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.